THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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ELECTRICAL INDUSTRY.

As is customary at this period of the year, our pages have to be added to in order to accommodate the large volume of matter of a financial and industrial character that is issued by electrical companies. In the first issue of the year only a general summary of the position is possible, but by the end of March one can review it with more precision by the aid of directors' reports and chairmen's speeches. Nobody wishing to keep himself intelligently informed concerning the state of the electrical industry, either in manufacturing or in electricity supply, can afford to ignore these statements, and we believe that many of our readers make a practice of reading them in full, laborious as that may seem to the non-industrial or non-financial mind. Some may content themselves with making their own selection of what to read, but we are all interested either as workers or investors in the electrical industry in knowing what others have accomplished and are expecting to do. Most business people make a practice of looking upon the affairs of others at times.

So far as manufacturing reports for 1913 are concerned, there is certainly little reason for complaint. Better dividends on ordinary capital and hopeful speeches are fairly general, and the amount of work in hand is gratifying—in some cases, if rumour be correct, it is exceptionally good—promising equally satisfactory returns a year hence.

Hardly less satisfactory have been the statements made by the great electricity supply companies operating in the London area. The ordinary shareholder in many cases has had reason to be more pleased with his rate of interest, which rose in spite of the heavier cost of coal. So far as 1914 has gone, coal prices have fallen, but it is unsafe to say whether the drop is going to continue, for hopes have hardly been expressed when news of serious labour trouble in important coalfield districts comes to hand. The companies in certain cases have made it plain that they fully appreciate the growing importance of heating and cooking business, and the large extent to which they will depend thereon in the future.

The great subject of the year for all the London electric supply companies, however, has been the necessity for doing something to put the whole supply business of the district on to a better basis, giving greater uniformity and efficiency. The matter has been brought into prominence by the promotion of the London Electric Supply Bill concerning which it is unnecessary to say anything here at this juncture, seeing that the different points of view of parties in conflict have been so fully published in our "City Notes." Without discussing the merits of the controversy that has arisen, however, we must express regret that the matter was not so handled as to avoid the exhibition of boards divided. The majority of the companies seem, so far as we can gather, to be opposed to the "holding" company, and it is understood that they are themselves preparing a scheme for which they hope to be able to secure the approval of the London County Council. The Council and Parliament may be trusted to safeguard the interests of the public in respect to deferring the purchase date, and they will decide which, if either, of the rival schemes London shall have; before they do so the question will doubtless be discussed in great detail, and the comparative merits of rival propositions will be examined. All we hope is that the question will not be once again indefinitely shelved. It is in the best interests both of London and of electrical progress that the way should now be freed from every complication that hinders the public from having an efficient, cheap and developing electric supply assured for it in perpetuity.

The I.E.E. Theatre.

More than three years ago, when describing the new home of the Institution of Electrical Engineers, we referred to the lighting of the lecture theatre as "highly effective," and "a typical application of modern scientific methods to the solution of a difficult problem of illumination." We thought so at that time, and we believe that the installation was generally regarded as satisfactory, in respect of intensity of illumination and freedom from objectionable glare.

But in the course of three years changes take place; the novelty has worn off, the candle-power of the lamps has probably decreased somewhat, and above all, the reflecting efficiency of the white frieze appears to have greatly depreciated. At the same time the mahogany panelling has doubtless grown darker. Whether due entirely to such causes as these, or not, we cannot help feeling that there is an indefinable something that is wanting or at fault, an element that militates against the comfort of the audience, and gives one the impression of being seated at the bottom of a mahogany box. It is very difficult to distinguish the features of a friend across the room—almost impossible to say whether his eyes are open or closed. There is a striking lack of contrast, of definiteness; while there is an abundance of light on the horizontal plane, there appears to be too little at an angle with that plane.

Members of Council see things literally from a different point of view, and probably very much better; the cornice over their heads is bright and clean, whilst on the other three sides of the hall it is grey, and they are at the centre of the semicircle; consequently they are unable to realise the appearance of the hall as seen by others less favourably situated.

The direct light given by the mercury vapour lamps adds to the illumination on a horizontal plane, but is mainly tangential to the vertical, to the faces of members, and to the mahogany panels; moreover, the light of the mercury-vapour lamps is practically devoid of the rays that are not absorbed by mahogany, so that the latter, to them, is black. The names of bygone heroes carved on the mahogany cannot be deciphered across the hall, and everything is dull and monotonous in appearance.

A few flame arcs or high-candle-power incandescent lamps above the ceiling would probably make all the difference. The lighting of the King's Hall at the Holborn Restaurant, for example, is excellent, partly no doubt because the reflective power of the walls is enormously greater than in the lecture theatre, but largely due to the more suitable colour and intensity of the flame arcs in the roof. Whether we have voiced the feelings of many members of the Institution we do not know; perhaps they will tell us, by way of our "Correspondence" Columns.

The Rubber Market.

The auction sales in Mincing Lane last week went off remarkably well, especially when it is remembered that a record quantity of the commodity was presented for disposal. For most of the parcels presented firm prices were realised. While pessimistic opinions continue to be ventilated in certain quarters, the general impression is that the market is on a reasonably safe basis at round about current prices, and that at all events there is not likely to be any material deterioration from the present level. The fact that the fortnightly auctions are beginning to deal with rather unwieldy quantities of rubber, has led to suggestions that there should be weekly sales held, but for the present there seems to be rather strong opposition to the proposals in important quarters, and under the circumstances the matter must be deferred till a later date. Eventually, however, there must be some alteration in the existing arrangements, for the growth of the supplies creates a problem which will have to be tackled sooner or later, and the only practicable device appears to be to hold the sales more frequently than is the case at present.

The cost of production is coming down quite fast where the better managed plantation companies are concerned, and the reduction notified by the Batu Caves Co. is little short of astonishing, 6d. a lb. in the year, from 1s. 6½d. a lb. in 1912, to 1s. 0½d. in 1913. Probably, too, this cost will be reduced further, while the crop harvested increased from 370,000 lb. in 1912 to 506,000 lb. in 1913. For the current year the output is estimated at 530,000 lb., but this will probably be exceeded. This is more or less typical of the progressive nature of output, and reduction in cost which are going on amongst the plantation rubber concerns of the Middle East. There are few, indeed, which can match this showing, but the tendency is strongly in the direction indicated, and the next few years will certainly see remarkable progress made along these lines. Ultimately, no doubt, rubber prices will drift to a lower level, but for the present there seems to be no reason to look for any great falling off in values. The official figures of the exports of rubber from the Federated Malay States in January give the total as 2,542 tons, compared with 2,130 tons in January of last year.

Much interest centres upon the efforts made to open up new rubber consuming industries, and the Secretary of the Rubber Growers' Association now announces that the proposal to provide a temporary street covering of rubber to be used in place of straw during cases of illness has been abandoned. Repeated experiments were made with a view of overcoming mechanical difficulties, and these were ultimately successful, but it was found that a satisfactory covering could only be made of a weight that rendered it unwieldy, and this involved a prohibitive cost so far as private enterprise was concerned. That the efforts to discover new uses are being pushed forward, however, is shown by the fact that suggestions to grant a subsidy, payable in rubber, for obtaining trials of the following applications of the material are under consideration—rubber-faced blocks of wood for street paving, and rubber covering for concrete or cement lawn tennis courts for indoor play. It is also proposed that a rubber flooring should be presented to some church in London in which the noise of footsteps during the service is found to cause interruption. Sooner or later, no doubt, rubber will come into general use for such purposes, but the cost is at present pretty high.

British Manufacturers in Australia.

The annual report of the Australian Association of British Manufacturers and their Representatives for 1913, just received, shows that that very useful organisation has made good progress during the third year of its existence. Subscriptions from membership were £368, as compared with £281 in the previous year, showing growing support, and the distribution of the Association's directory of British manufacturers has been actively proceeded with, some 7,000 copies having been circulated. Effort was directed towards obtaining greater uniformity in the general conditions of tenders invited by Government departments, municipalities, &c., a joint committee of this Association and of the Victorian Institute of Electrical Engineers having made suitable representations in the proper quarters through H.M. Trade Commissioner in Australia. It is expected that results of considerable benefit to contractors will be obtained. A large number of applications for investigation of the effect and operation of Tariff Acts has been placed before the Commonwealth Inter-State Commission, urging the necessity for increased preference in favour of British manufacturers, and considerable benefit to British trade is expected to follow. It is considered that the Association is now sufficiently well established to make representation in England desirable. Mr. Percy Rosling, an ex-president of the Association, who, as our readers are aware, is now in this country as right-hand man to Mr. George Sutton, of Henley's, has the matter in hand, and he will recommend a suitable representative. We congratulate this Association on the satisfactory progress so far made, and would urge British electrical and engineering firms still further to strengthen its position in prestige and opportunity of usefulness by authorising their representatives to become members.

AN AMERICAN RAILROAD WIRELESS EQUIPMENT.

In view of the interest which has been taken in this country in the question of communicating by means of wireless signals between a fixed point and a moving railway train, it may be appropriate to give some brief particulars concerning work which has been accomplished in this direction on an American railroad. For the information contained herein we are indebted to Mr. L. B. Foley, the telegraph superintendent of the Delaware, Lackawanna and Western Railroad Co., and also to information which has appeared in the *Scientific American*, the *New York Times* and other American journals. Experiments have been conducted by the Railroad Co. mentioned for some considerable time with a view to effecting communication with moving trains, and wireless stations equipped with aerials

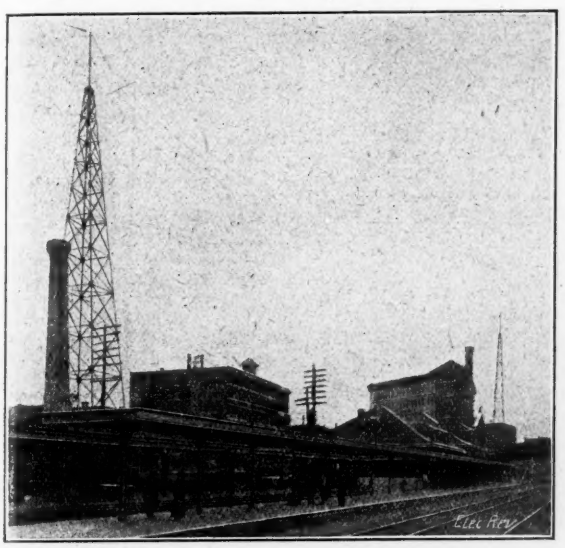


Fig. 1.—Binghamton Wireless Station.

supported on high towers have been installed at Scranton, in Pennsylvania, and Binghamton, in New York, with a working radius of about 300 miles. Fig. 1 shows the Binghamton passenger station with its aerial. The means of collecting and transmitting signals on board the Lackawanna limited train is shown in fig. 2. The antenna adopted for this installation consists of a quadrangle of wire placed at a height of 18 in. above the roof of the car, four adjoining cars of the train being used in this way and each quadrangle being connected to the next by a special attaching plug. The wireless apparatus, which is of the regular Marconi type, is attached to the quadrangles at about the middle point of the aerial system thus constructed, the operator's station being placed in a compartment of the third car of the group. Fig. 3 shows the wireless office on board the train. The only difference from the ordinary system of working, apart from the details mentioned above, is that the power is furnished by a special motor-generator set driven from the ordinary train-lighting dynamo, while the earth connection is made to the rails by a wire leading to one of the car trucks. The aerial, which is of heavy copper wire, is insulated by large porcelain insulators mounted on iron posts on the corners of the car, so as to withstand the sending voltage of between 8,000 and 9,000 volts. The distance between Scranton and Binghamton is about 65 miles, and we are informed by Mr. Foley that during last December the system of communication between the wireless apparatus at the fixed station and a train moving at 60 to 70 miles an hour was perfected.

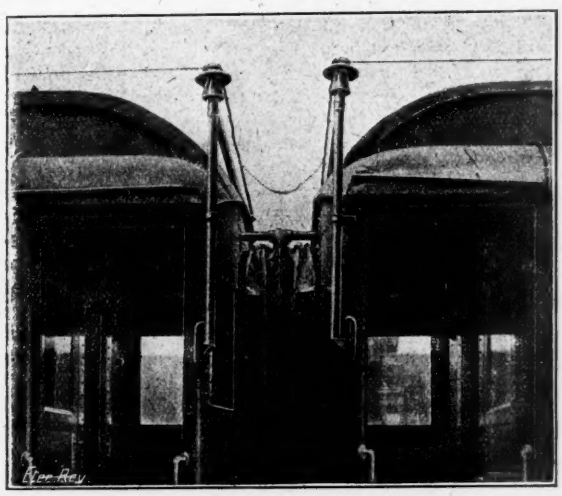


Fig. 2.—Antenna on Passenger Coaches.

An interesting instance of the usefulness of this device was furnished comparatively early in the practical tests of the apparatus. On one occasion the conductor in charge of the train leaving Hoboken for Buffalo was taken ill whilst

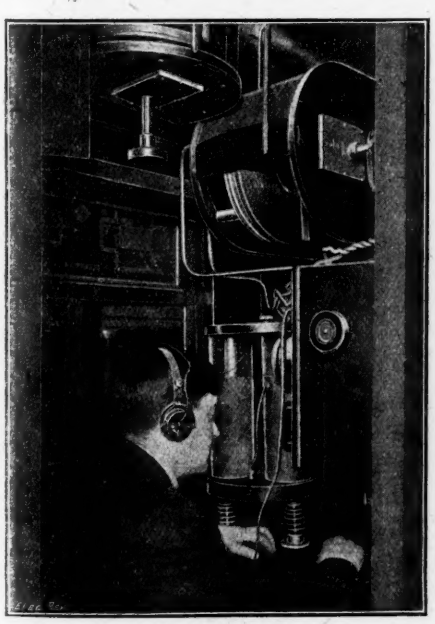


Fig. 3.—Receiving Apparatus on the Train.

Fig. 4.—Wireless Station at Scranton.

the train was running at 50 miles an hour, 30 miles from Scranton. This, under ordinary circumstances, would have entailed a delay in order to send a telegraphic message ahead to obtain a relief conductor, or else a wait at Scranton. With the wireless equipment, however, the conductor notified the wireless operator, and, in spite of the intervention of mountainous country between the train and Scranton, the wireless message was sent forward, with the result that a relief conductor stepped on board as soon as the train pulled up at the station in the ordinary way. It has also proved useful in forwarding instructions for attaching special coaches. Later experiments dealt with the raising and lowering of semaphores from a distant station, and it now appears to be possible to set such signals by wireless from the moving train or from a fixed wireless station. A selective device is used by which the operator can set a signal at any point if has occasion to flag a train. Hence if any mistakes were made in the orders given to drivers and conductors at stations, or should an emergency arise in which the train must be stopped to avert an accident, the station operator could signal the train as certainly as if he had direct wire communication.

Another feature of economy is in connection with freight trains. It is obvious that keeping freight trains in motion for long distances without stops must result in economy of operation, as it is expensive to start and stop heavy freight trains. Having direct communication with a train and with the possibility of setting and releasing signals by wireless, the dispatchers can keep in touch with the conductors and make stops no longer a necessity. Even in the case of wreckage or derailment, unless the damage is very severe it is evident that wireless messages dispatched from the train in question will probably save much property, and very possibly will effect a saving of life. At the time of writing it appears that still further developments may be expected in the application of wireless control to railroad practice, and it will be very interesting to watch the future evolution of this feature on the system of the railroad company that has had the foresight to adopt wireless work in connection with its ordinary commercial operation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Time Allowed for Tendering.

Will you give space in your columns to draw the attention of municipal engineers generally to a grievance which we ourselves feel, and which must, we think, be generally felt by all firms sending in offers in response to advertisements? We refer to the fact that the applications for specifications are not attended to on Saturdays. Most advertisements of tenders appear in papers issued on Friday, and although cheques are sent so as to reach the proper quarters on Saturday morning, the specification is rarely sent off till Monday, reaching us on Tuesday. Now, it is very seldom that under the best circumstances really sufficient time is given to prepare tenders, so that every day is of importance. We may say that almost all engineers are alike in this respect, as out of over 20 specifications applied for under these circumstances during the last few months, we can only trace two that arrived on the Monday morning, and in two or three cases, special requests for the dispatch of the specification by return, owing to the short time allowed, have been without result.

At the same time, we are convinced that if the attention of the engineers was called to the matter, they would willingly make arrangements to remove this hardship.

Whilst on the subject of tenders, we are inclined to ask if something cannot be done to ensure adequate time being allowed for their preparation. Some engineers, we admit, give sufficient, indeed, ample time for this, but many allow a time which is only just sufficient, while some give so short a notice that it is almost impossible to get together the full details required in the time allowed, and this fact suggests to one the thought that such tenders are cut and dried for special makers. It is interesting to notice that the parties interested will often take six or eight weeks to decide on a tender where the time allowed for preparation has been curtailed (according to the engineer) on the score of urgency.

Surely it would be possible for the I.M.E.A. and B.E.A.M.A. to decide on the minimum time to be allowed for each class of tender, on the understanding that engineers should, in all cases, allow 25 per cent. to 50 per cent. more wherever possible. It would be very interesting to hear the views of other tenderers on this subject—for ourselves we suggest the following minimum :—

Turbo-alternators, four weeks.

Converters, motor-generators, switchboards, three weeks.

Cables, other smaller and simple requirements, two weeks.

These times should be counted from the time when the specifications are ready, or from the date of the advertisement, whichever is latest. We mention the question of the time the specifications are ready, as it is not by any means an unknown circumstance for the issue to be delayed through the specification not being ready when first advertised.

H. W. Butler & Co.

London, *March 14th*, 1914.

The B.E.A.M.A. having approached the I.M.E.A. on the above question, the I.M.E.A. Council have resolved that the request of the B.E.A.M.A. "that not less than three weeks be allowed for the preparation of tenders for turbine plant" is reasonable, and they ask their members to act in accordance with this view whenever practicable.

H. Faraday Proctor,
Hon. Sec., I.M.E.A.

Bristol, *March 12th*, 1914.

Electric Vehicles—Standard Charging Plug.

In your issue of March 6th you refer to the report of the Electrical Vehicle Committee, and from this report it appears that the Committee have recommended that a certain type of 150-amp. plug be adopted as the standard for Great Britain.

It is stated that it is not considered desirable or necessary that any provision should be made for earthing.

In coming to this conclusion, the Committee appear to be influenced by the fact that electrical vehicle batteries, as generally used, only require about 120 volts for charging, and that under the present Home Office regulations earthing is not considered essential at this voltage. In the majority of cases these vehicles will be charged from the lighting or traction supply, and in order to obtain the highest efficiency possible, reducer type motor-generators will be used in preference to ordinary motor-generators. The Committee appear to have overlooked that in these cases it is possible to get a voltage to earth on the generator cable and battery as great as that in the system from which the reducer set is run; that is to say, on a lighting system 200 to 250 volts to earth, and on a traction system 550 volts to earth.

It is surely therefore advisable that efficient means should be provided on every plug for earthing the flexible cable and the vehicle during charging. It will be much to be regretted if by the omission of this precaution accidents are caused which would have a prejudicial effect on the development of this new and promising opening for the use of electricity.

H. W. Bosworth.

London, S.W., *March 12th*, 1914.

[We cordially agree with our correspondent. If an earthing connection is not provided in the first instance, it will certainly have to be adopted eventually, and it would be far better to do it now.—EDS. ELEC. REV.]

Protection or Tyranny?

Thank you for your foot-note to the communication signed "Junius" in your current issue. No such rule exists.

D. N. Dunlop,
Secretary, The British Electrical and Allied Manufacturers' Association.

London, *March 14th*, 1914.

There have appeared recently in your columns, under the heading of "Protection or Tyranny," some letters which I have thought supplied their own condemnation, and I have therefore found it easy, in refraining from any sort of comment or reply, to adhere to the desire of the council of the Manufacturers' Association.

I observe to-day a letter signed "Junius," and therein lies his principal claim to my consideration, concerning which I desire to make this statement. If any such rule, or any semblance of such rule, or any latent desire for anything in the nature of such a rule, existed in the Manufacturers' Association, Lord Ampthill would not be its President, I should not be chairman of the council, nor, I am sure, would any member of the council be content to occupy that position.

No such rule could be desired by any employer, either in or out of the Association, who has understanding of his business. I am distressed that anyone, apparently within the ranks, should so utterly, and so stupidly, misjudge those who are striving to guide a sorely-tried industry into paths of prosperity.

A. Bruce Anderson.

London, *March 16th*, 1914.

Staff engineers in general will thank you for so courageously publishing in your current issue the letter in which "Junius" refers to the alleged rule of the B.E.A.M.A. regarding the interchange of staff members of engineering firms. You will remember that the understanding that such a rule was being enforced was largely responsible for the formation of the Staff Engineers' Association. If the members of the B.E.A.M.A. respond to the call of your Editors either to confirm or refute the suggestion referred to, one might also ask whether the ramifications of the B.E.A.M.A. do not go so far as to forbid even the consideration by certain firms of applications from staff engineers in the employ of competitive firms?

L. H. Fletcher,
Hon. Acting Secretary, Staff Engineers' Association.

London, E.C., *March 16th*, 1914.

Reversing an Interpole Motor.

"Puzzled Winder" will find it quite simple to reverse the direction of rotation of any kind of motor if he realises that all that is required is to change the relation of the armature current to the field current.

The commutating poles should be considered part of the armature circuit, and therefore their relation should never be changed. The series and shunt windings of a compound motor together form the field of that motor, and therefore their relations should remain unaltered. It can now be left to anyone's discretion as to whether they change the armature circuit complete or the field circuit complete.

In a shunt-wound motor with commutating poles, it would certainly seem easier to change the field connections.

F. Gould.

Birmingham, *March 16th*, 1914.

In reply to "Puzzled Winder," interpoles are used to gain good commutation, and as this requires an increasing reversing field as the current through the armature increases, the polarity of the interpoles is important. In the case of a motor, the polarity should be the same as the next main pole behind it in the direction of rotation. To reverse the direction of rotation of the machine, it is not sufficient to reverse the brush leads—*i.e.*, direction of armature current alone, as the sequence of poles would be wrong, with the result that the machine would not come up to speed, and on load would spark vigorously. If the machine has run correctly under load in one direction, then the best and surest method of changing the direction is to change over the interpoles and turn the brush rocker (assuming it is a four-pole machine) through 90°. This is quickly done, and the result is satisfactory. The same applies either to a shunt-wound or a compound-wound motor.

G. N. Hurst.

London, *March 16th*, 1914.

Referring to "Puzzled Winder's" letter, appearing in your issue of the 13th inst., to change the direction of rotation of a shunt interpole motor, it is immaterial whether the field or armature current is reversed. The former may be accomplished by changing over the shunt leads, and the latter by changing over the brush leads. If the field current is reversed, the interpoles must remain the same polarity for either direction of rotation, but if the armature current is reversed, the interpole current must also be reversed (by changing over the + and — terminals instead of the brush leads this action is obtained).

"Puzzled Winder" may find the following useful: Interpoles always "lead" in a motor and "lag" in a generator; that is to say, in the case of a motor the interpole preceding a main pole in the direction of rotation must be of the same polarity as the said main pole, and in a generator the interpole following a main pole in the direction of rotation must be the same polarity as the main pole.

As regards compound interpole motors, care must be taken to reverse the main winding also; otherwise, if the machine is accumulatively wound in the first place, it will run up differentially wound, which may cause it to attain a dangerous speed.

W. D. Lovell.

Middlesbro', *March 16th*, 1914.

[Our thanks are due to many other correspondents for their kind assistance.—Eds. Elec. Rev.]

A Motor Problem.

In this week's Electrical Review a gentleman who signs himself "Perplexed" seeks assistance with a shunt-wound motor where the power required is not proportional to the speed. I beg to offer him the following solution:—

The motor should be of the shunt wound, double armature type; that is to say, having one armature with two distinct but equal armature windings and two commutators.

The motor design should be such that the following outputs are possible with shunt regulation.

1. Armatures coupled in series. 10 B.H.P. with 300 to 350 R.P.M. continuously.

2. Armatures coupled in parallel. 15 B.H.P. with 350 to 400 R.P.M. continuously.

The field must be so constructed that under all normal conditions sparking will not occur.

This class of motor has an excellent efficiency and gives no trouble if the design is correct.

N. H. W.

As it is a characteristic of an electric motor that it only develops the power that is demanded, it is only necessary to consider the maximum power required and the speed.

It appears that what is necessary in this case is a motor of 15 H.P. with a range of speed regulation from 325 to 400 R.P.M. The power developed will depend entirely upon the machine to be driven, and "Perplexed" need not consider the point as to whether the load is proportional to the speed or not.

F. Gould.

Birmingham, *March 16th*, 1914.

Maintaining High Power Factor.

1. Is there any "Regulation" or recognised rule limiting the use of larger transformers than the load requires, or larger motors? In such use, with induction motors, the power factor of the system would be adversely affected.

2. Can a power user be compelled to install plant to maintain his power factor at any fixed minimum?

3. What is the simplest determination of the excess capacity of motor necessary to correct power factor when the required horse-power output is known?

4. Have papers appeared in Institution *Proceedings* dealing with the solution of such problems, or are they included in standard text-books, and in which? **R. E. M.**

The Electric Lighting of Garden Villages.

I have read with interest the various articles and letters upon village lighting which have appeared in your columns, but have seen no mention of the lighting of garden cities and garden suburbs. Considering that there are now over 60 such schemes, with provision for from 20 to 8,400 houses each, this seems passing strange; especially when one considers that the area, roads and positions and number of dwellings, shops, public buildings, &c., are settled before building is started. One would have thought that such places presented ideal conditions for planning the size and position of the central station beforehand. And yet I do not remember having read of any such schemes.

I know a man who has planned a garden village to contain some 300 houses of a superior type. Building started last year, and the place promises to be very successful. When I asked where the central station was to be, my friend said, "Oh, I cannot bother about electric light; the company is sure to run the gas main from ——."

Perhaps the start is the difficulty. It is so in my own case. I am about to put up about a hundred small houses on my own ground, and wish them to have the advantages of electricity. But how are the first few houses to be supplied without sinking a lot of capital in a plant and battery capable of supplying the whole number?

Any suggestions that my fellow readers may have to offer will be esteemed, and will not, I am sure, be without advantage to the industry.

Garden Citizen.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Improved Controller Finger.

We have received from Messrs. Dyer & Young, of Empire Works, Stansted, Essex, particulars of an improved patent controller finger, fig. 1, which they are manufacturing.

The design is intended to get direct contact from terminal to drum segment without the spring carrying any current; also to reduce waste of copper at the contact point of the ordinary finger.

The top of the base A has interlocking teeth engaging with others on the spring holder B, and is screwed to the latter, the interlocking teeth providing adjustment for taking up wear on the contact point C. Adjustment or tension on spiral spring is made with nut D. Plunger E is provided with a pin working in a slot in base A to prevent any turning of the contact. At the end of plunger E ample

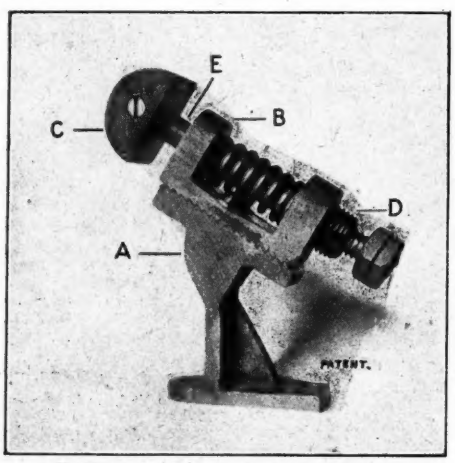


Fig. 1.—Patent Controller Finger.

provision is made for connecting suitable flexible cable with the terminal in controller case. By removing the two screws from the base, the spring holder, together with contact, can be removed at once.

These controller fingers are designed for use on B.T.H., Dick, Kerr, Westinghouse and Witting controllers.

In order to reduce the cost and number of parts, the base and spring holder have been designed to meet all types of controllers. The contact tips are all made from 1 in. half round H.D. copper, the width varying from ⅜ in. to 1 in. to work in with standard drum segments.

B.T.H. Switch Plug.

We have received from the British Thomson-Houston Co., Ltd, of Mazda House, 77, Upper Thames Street, E.C., particulars of an ingenious interlocking switch plug for use on heating and cooking circuits. The object aimed at is to make it impossible for the plug to be inserted when the switch is in the "on" position, and to ensure that the circuit is broken before the plug is withdrawn.

The feature of this plug is the method adopted for achieving this object. There is no mechanism at all, the interlocking action being achieved by having the knob of the switch in such a position that it overlaps the plug, so to speak. When the switch is on, the plug cannot be pushed in sufficiently far to make contact, owing to the interposition of this knob. In the same way, on withdrawal the switch is pushed off by the fibre guard of the plug.

This arrangement is explained in the accompanying diagram, fig. 3, which shows the knob (dotted) in the "on" position; it will

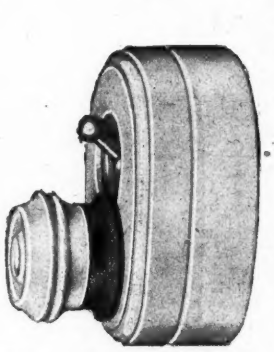


Fig. 2.—B.T.H. Interlocking Switch Plug.

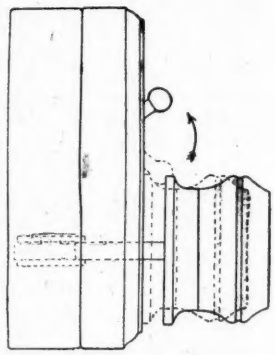


Fig. 3.—Diagram showing Operation of Switch Plug.

be seen that the plug cannot be pushed in any further without switching off. The figure also shows in full lines how the knob of the switch is thrown over when the plug is pulled out.

The switch is at present made with a carrying capacity of 5 amps. in the pattern illustrated, but there is a 10-amp. size and a flush pattern in preparation.

A Conduit Ceiling Rose.

Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, have introduced a new type of ceiling rose termed the "Condulet," which consists of a specially shaped porcelain, carrying large terminals of special design, and a cover for the conduit box. The porcelain is so arranged that it is firmly fixed in position, so that there is no risk of the terminals accidentally touching the sides of the iron box and causing a short-circuit.

The terminals fitted are of large size, hexagonal in shape, and have a slot in the centre, a portion of the slot being tapped to take a grub screw. With this design of terminal, there is no necessity to sever the conductor when wiring, it being only necessary to bare back a portion of the insulation—say, about ½ in. — place the exposed conductor in the slot, forming an efficient contact, and secure by the grub screw. The terminals are of sufficiently large size to allow of a cheese-head screw being tapped into the side to take the flexible conductor. It will be noticed that with this arrangement it is possible to attach the

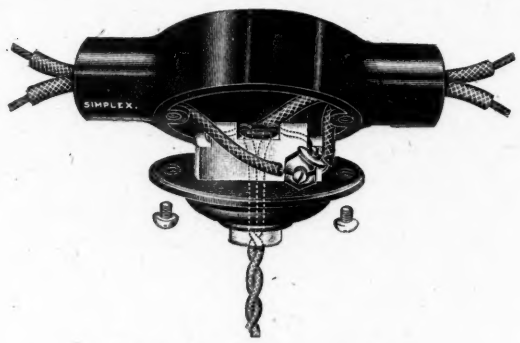


Fig. 4.—Condulet Ceiling Rose.

flexible conductor to the terminals, together with its lampholder at the bench, instead of, as is usual in wiring ceiling roses, having to work in an awkward position on the top of a ladder.

The grip-in arrangement of the flexible is of neat design, and effectively relieves all strain or direct pull on the terminals. The flexible is taken through a centre hole in the porcelain and through the cover in such a manner that the pull is directly downwards; but, as a further precaution, a small rubber ring is fitted, which, by the weight of the shade on the end of the flexible, is compressed, and forms an effective grip. This rubber ring has

a further advantage in that when compressed it acts as an effective anti-vibrator, prolonging considerably the life of metal-filament lamps. The cover which is fitted is of considerably better appearance than the ordinary white porcelain rose, and with our standard type is of black enamelled iron ; but for use in living rooms, and so forth, where appearance is a consideration, a cover in any finish can be used, so that it is in keeping with the style of fitting installed. The low projection of the whole fitting is a further advantage. The fitting is supplied with the standard type of circular box 2⅜ in. × 1⅛ in. deep, in all the combinations, terminal through centre hole, &c.

Half-Watt Lamps with Holophane Glassware.

We have received from The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., a supplement to their recent price list of fittings for half-watt lamps. This additional leaflet illustrates four new fittings—*i.e.*, "Marquis," "Earl," "Noble" and

Fig. 5.—Half-watt G.E.C. Holophane Fitting.

"Peer," which are specially designed to harmonise with Holophane glassware. Each fitting is listed in two sizes, so that the diameter of the glass is either 14 in. or 16 in., and the half-watt Osram lamps that are recommended for use are 300-500 watts and 500-1,000 watts respectively.

Jardine Pulleys.

Messrs. John Jardine, of Deering Street, Nottingham, send us particulars of some new fast and loose pulleys which they have just placed on the market.

The pulleys follow the same general design illustrated by us on May 30th, 1913 ; the loose pulley runs upon a C.I. sleeve fixed to the shaft by a grub screw, and has a recessed boss—the recess forming an oil reservoir. An oiling tube passes into the recess almost up to the shaft, thus preventing the oil from being thrown out by centrifugal action. The oil runs to the bottom of the recess when the pulley is stationary ; drips on to the C.I. sleeve at starting, and is held by centrifugal action in the bottom of the recess when the pulley attains full speed.

Standard sizes vary from 6 in. to 24 in. diameter, with from 3 in. to 4 in. faces.

Small Ventilating Sets.

The Sturtevant Engineering Co., Ltd., of 147, Queen Victoria Street, E.C., have recently introduced a series of small "ready-to-run" self-contained ventilating sets, each consisting of a small motor and enclosed fan.

These are made in three sizes, for 75-150, 150-300 and 300-450 cb. ft. of air per minute ; the motors are wound for any pressure up to 220 volts D.C., and can be connected to any ordinary lampholder, without special switchgear.

They are specially suited for use in small offices, kitchens, smoking rooms and similar situations, where a *positive system* of ventilation is required and where propeller fans cannot be applied.

When desired, the fan inlets and outlets can be furnished with canvas hose connections, and the apparatus can be carried from room to room, being light in weight—from 20 to 40 lb., according to size.

The "ready-to-run" sets were originally designed to meet the requirements of the U.S. Government for use in battleships, but have since found a variety of uses in domestic and business premises.

A New Candle Lamp.

Messrs. Veritys, Ltd., of 31, King Street, Covent Garden, London, W.C., have brought out a new patent candle-lamp, to be known as the "Aston" Verilite Candle, which we illustrate herewith. It will be seen that a small metallic-filament lamp is used,

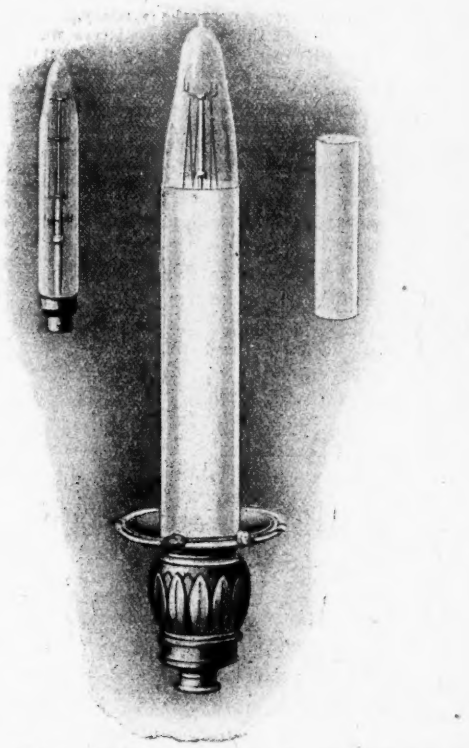


Fig. 6.—"Aston" Verilite Candle Lamp and Parts.

over which slides a white candle-tube, the whole of which is illuminated ; the tube is easily removed for cleaning without interfering with the lamp, and the latter fits any standard B.C. holder. Ventilation is provided for, and the tube is always vertical.

New Belling Griller.

The accompanying illustration shows a new griller which is being put on the market by Messrs. Belling & Co., of Derby Road, Edmonton, N. It is fitted with seven Belling standard fire-bars (all in parallel), having a total loading of 2,300 watts, and three degrees of heat at the "medium." The three centre bars come on only for small work. The top, together with the elements,

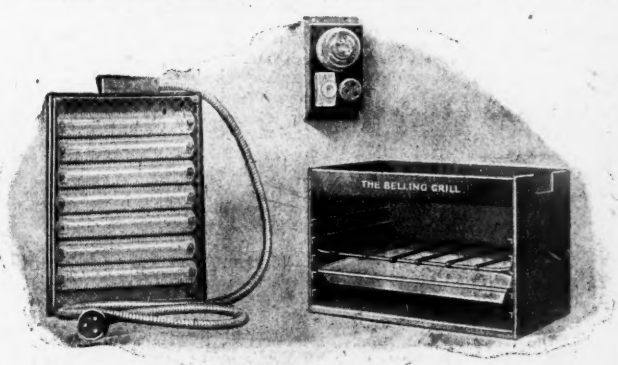


Fig 7.—Belling Griller.

wire guard and all connections, is removable from the body in a few moments. The cooking space is 15 in. long × 8 in. high × 12 in. deep, and the construction is of sheet-steel with wired edges, making a light portable article. A drip-pan is provided, as well as a loose front plate for converting the griller into a small oven. The three terminals are outside and perfectly cool.

D

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

At the annual meeting held at the Trocadero Restaurant on March 6th, the chairman, the Hon. Arthur Stanley, M.P., in moving the adoption of the report and accounts, said that the revenue from subscriptions amounted to £805, as compared with £734 last year, and an increase of 50 per cent. over 1907, which was the first year of the Association's reconstruction. The expenditure was £657, as against £640. The net result was a surplus of receipts over expenses of £148, against £86 last year. Remembering that some years ago the Association had become almost moribund, the figures reflected very great credit upon the secretary, Mr. de Turckheim. It was unfortunate that the rating appeal case went against the Association in the House of Lords. They deplored the result, but the strong and unanimous judgment in their case in the Court of Appeal justified their taking up the matter. They owed a debt of thanks to those members who assisted financially in fighting the case, and he hoped that if they took up another case in the near future they might be more successful. This time last year the matters of guard wires and Post Office wires were under consideration, and their hopes of arriving at a safety arrangement with the Postmaster-General were duly fulfilled. The council considered that the settlement was a very fair one. The Somerset House authorities informed them that the settlement reached in 1909 with regard to assessment for income-tax purposes for a period of five years was now to continue for a further five years (until the 1917-18 accounts). Two special committees were at present sitting in connection with questions referred to the Association by the Board of Trade, and they would report before long. It was very satisfactory to the Association to have questions referred to it by the Board of Trade. After alluding to the successful Congress at Blackpool, the speaker remarked that they had received an invitation to Newcastle-on-Tyne for their next Congress, and he hoped it might be possible to go there. It had been definitely arranged that the 1915 Congress should be held in London. The report was adopted, and the following were elected to the council:—Mr. F. Bland (Edgar Allen & Co.), Mr. C. W. Mallins (tramway manager, Liverpool), Mr. R. R. Greene (tramway manager, Wallasey), Mr. A. V. Mason (general manager, South Metropolitan Tramways), Mr. R. S. Tresilian (secretary, Dublin United Tramways) and Mr. R. J. Howley (joint manager, B.E.T.).

At the annual dinner and smoking concert of the Association, which followed, Viscount Chilston, President of the Association, was in the chair.

After the usual loyal toasts, Mr. Harry England (vice-president) proposed "Our Guests," and in doing so he offered a welcome to the new president, Viscount Chilston. Their guests were the representatives of the permanent officials of the Board of Trade, of the Municipal Tramways Association, and of their hosts at the Blackpool Conference. During the year the Board of Trade had recognised that the M.T.A and the T. and L.R.A. were powers in the land, and had consulted them as to the new working regulations that they contemplated making. They hoped that the Board would continue to take them into confidence, and that the present amicable relationship would long continue. The strained feelings between the M.T.A. and the T. and L.R.A. had entirely disappeared, and to-day they were working amicably together on anything affecting their joint interests. The speaker coupled with the toast the names of Alderman Linsley, the President of the M.T.A., and Alderman Rodgers, of Newcastle. Alderman Linsley referred, among other matters, to the desirability of the good relations continuing between the two Associations, and between the Association and the Board of Trade. He had had a good deal to do with Col. von Donop, and if ever there was a point on which the latter could give way, he was always willing to do so. He hoped that the M.T.A. would have the pleasure of seeing some T. and L.R.A. members at the Conference at Salford next September. Alderman Rodgers, in his reply, assured the Association that if they went to Newcastle they should have a hearty Northern welcome.

Mr. J. M. Henderson, M.P., proposed "The Tramways and Light Railways Association." He referred to the objects of the Association, which now had 450 members—a record; he also referred to the capital expended upon, and the receipts of, the 2,626 miles of tramway in the United Kingdom. He amused his hearers with a calculation regarding the period which would be occupied (working an eight-hour day, of course) to count 300 million coppers (one per passenger per annum). There was no enterprise in the kingdom that required more protection than tramways. From the very moment that a tramway enterprise was conceived and brought forth, it met with tribulation at every turn. A Bill first met with opposition in the Houses of Parliament from local authorities, whose object was not far to seek. They wanted the tramway, but, at the same time, a little street lighting and a little road widening at the tramway's expense. He thought, however, there was a better spirit coming over the minds of the public with regard to these public enterprises, and Associations like theirs would help to encourage it and to lead the public to see that it was to their interests to assist and not to obstruct tramway enterprise. Lord Chilston responded to the toast. He said that tramways fulfilled a very necessary and useful purpose. The housing question was much to the fore just now, and the tramway enabled the overcrowded population to seek their homes outside the zone of their work. In regard to the rating test case in the House of Lords, they had got to accept the decision and look forward to finding, at some later date, compensation for the serious setback which that decision carried with it. They hoped that the spirit of loyalty and unanimity displayed by the members, especially in their response to the appeal for financial assistance, would be continued. Crises of such a kind showed the value of such an Association. The speaker briefly referred to the question of road maintenance, which, as tramways owners, they said ought to be paid for more by the motor-'bus and other heavy traffic which used their roads and abused their tracks and setts. Surely settlement of such a question ought not to be outside practical politics.

The Hon. A. Stanley proposed a vote of thanks to the President, who briefly replied.

PARLIAMENTARY.

London Electric Railway Bill.

A Select Committee of the House of Commons, presided over by Sir Luke White, on March 12th considered the Bill promoted by the London Electric Railway Co. for a number of powers, including authority to construct three new subways and an escalator at Tottenham Court Road Station, to connect the Charing Cross, Euston and Hampstead and Central London Railways; a subway and escalator at Piccadilly Circus; an additional subway at Trafalgar Square; and to acquire land in Broadway, Westminster, on which to erect new general offices. The only objection was by the Cannon Brewery Co. to the acquisition of a portion of St. James' Restaurant.

The Committee heard the case for the Brewery Co. in private, and subsequently passed the preamble of the Bill and ordered it to be reported for third reading.

Bonuses to Tramway Employés.—Lord Robert Cecil asked the Chief Secretary to the Lord Lieutenant of Ireland whether the Local Government Board auditor had surcharged the members of the municipal administration of the Belfast tramways the bonus paid to their employés; whether this had put an end to the profit-sharing scheme there in force; under what statute the auditor decided the payments were illegal; and whether the Government contemplated legislation to remedy this state of things. Mr. Birrell said the Local Government Board auditor surcharged salaries and wages to the amount of £2,800, paid on May 4th, 1912, to the staff of the tramways department in anticipation of profits estimated as likely to be earned in respect of the year ended March 31st, 1913. The Board had no official information as to the second paragraph of the question. The auditor's reason for making the surcharge was that the payments in question were not authorised by law. As regarded the last paragraph, it was open to the Corporation to initiate any such legislation if they so desired. The surcharges in question were remitted by the Board on appeal.

Brentford Gas Bill.—Lord Hylton's Committee of the House of Lords has passed the preamble of the Bill of the Brentford Gas Co. Part 10 of the Bill gives the company power to apply for provisional orders to supply electricity.

Ashington Gas Bill.—After considerable opposition, Mr. Mount's Select Committee of the House of Commons passed the preamble of the above Bill, by which the Ashington Urban District Council seeks to acquire the gas undertaking of the Ashington Coal Co. In the course of examination, Mr. E. V. Southern, the agent of the Ashington Colliery, admitted that the company had an understanding with the electrical company not to push the sale of gas in the district. Mr. R. P. Sloan, manager of the Newcastle-on-Tyne Electric Supply Co., gave evidence in opposition to the Bill, and said the company had an agreement to manage the business of the Northern Counties Electricity Co. in the district of Ashington. The latter company had spent £40,000 in the Ashington area recently. His company had spent £3,000 on a new sub-station and other works at Hirst, and the result had been a large improvement in the lighting of the district. The charges compared favourably with those in similar districts. In a short time 70 per cent. of the houses in the district would be wired for electricity. If the Bill were rejected, they were prepared to give a supply to the district on reasonable terms.

Second Reading.—In the House of Commons on Monday, the Oxford and District Tramways Bill was read a second time.

Electric Steering for Petrol Cars.—A recent issue of the *Electrical World* refers to the possibility of the introduction of electric steering on petrol motor-cars, as a means of relieving the excessive muscular effort required with the ordinary steering gear on long journeys over rough roads. It is pointed out that the practicability and reliability of electric steering have been demonstrated on ships. The power demand of a motor-driven steering device is intermittent, and, it is suggested, would not exceed 30 watts, so that battery rating would not be much increased. The substitution of a compact little steering control lever for the present bulky steering column and wheel would give free access to the driver's seat from both sides of the car.

LEGAL.

Handley v. West.

In the King's Bench division, Mr. Justice Bailhache sitting without a jury had before him an action brought by Mr. George Douglas Handley, living at Oak Hill, Spring Vale, Isle of Wight, against Mr. Allen West, of Brighton, and Queen Victoria Street, London, claiming to recover a sum of money said to have been paid by the plaintiff for the use of the defendant and at his request, the claim being alternatively based upon a bill of exchange. There were a variety of defences, among which it was pleaded, that the plaintiff could not recover upon the bill, because the claim was barred by the statute of limitations, and it was also contended that under the particular circumstances the money could not be recovered in the action by the plaintiff.

Mr. J. B. Matthews, K.C., and Mr. MacNaghten were counsel for the plaintiff, and the defendant was represented by Mr. Schiller, K.C., and Mr. Douglas Hogg.

Mr. Matthews, K.C., in opening the plaintiff's case, said that his client was a director of a company called Handleys, Ltd., and the defendant, Mr. West, was his cousin, and a director of Allen West, Ltd., an electrical company of Brighton and London. The present claim arose out of a guarantee which the plaintiff, the defendant and a Mr. Wm. Thos. Pressland gave in respect to a loan made by a gentleman named Mr. Paul Speak to a company called the National Provincial Electricity Corporation, Ltd., of which the three guarantors named were directors. The history of the matter opened in the year 1903, when Mr. West, who had been through the war in South Africa, came home to England, and was desirous of getting set on foot a company so as to provide him with some medium of activity, and in this connection he approached the plaintiff and a firm called Cecil Cooper & Co., electrical engineers, with a view to forming such a company, and it was with a view to helping his cousin that the plaintiff interested himself in the matter. On March 27th, 1903, the National Provincial Electricity Corporation, Ltd., was formed, and its objects were in the main to carry out a scheme for electrically lighting certain towns in the West of England, and the original capital was £30,000, divided into 30,000 £1 shares, and at all material times the plaintiff and the defendant and Mr. Pressland were directors. Towards the end of 1905 the company were short of capital, and they borrowed £1,250 from Mr. Paul Speak, and it was agreed that Mr. Speak should be paid a bonus of £300, which was to carry interest at the rate of 24 per cent. About that time all the parties apparently were acting through a Mr. Harper, a solicitor, of the firm of Waterhouse & Co., and for the loan of £1,250 and the £300 bonus, debentures were issued to Mr. Speak, and the £1,250 was also collaterally secured by a bill of exchange drawn by Mr. Speak upon and accepted by the plaintiff, the defendant and Mr. Pressland, which bill was of the date of about November 30th, 1906. When the time came for the payment off under the bill—the due time being in about one year—the position of matters was as follows:—Mr. Speak was properly telling the three directors that they were jointly and severally liable to him; Mr. West's position was that he was not then in a position to pay his contribution of one-third towards the bill; Mr. Pressland's position was similar, and the plaintiff was able to put up the money. As a matter of fact, Mr. Pressland, by means of an arrangement made with the plaintiff's father, did eventually raise about £625, so as to meet his liability under the bill, and in the course of time the plaintiff gave to Mr. Harper, on behalf of Mr. Speak, a cheque for £1,250, which got rid of Mr. Speak, so far as the bill of exchange was concerned. The defendant, Mr. West, then gave to Mr. Handley a bill of exchange for £426 17s. 10d. at three months, this sum representing his third portion of the £1,250, with 10 per cent. interest over a period of three months. This was the bill of exchange upon which plaintiff sought to recover, and counsel added that over various dates Mr. Pressland had by instalments paid off the advance made by the plaintiff's father to him. As an answer to the bill, the defendant had set up the Statute of Limitations, among other defences, the writ having been issued in the action on April 25th, 1913. His client's case was that he could recover on the bill, or was alternatively entitled to sue for the money, as having been paid to the use of the defendant as one of the joint guarantors for the loan to the company.

Mr. Schiller, K.C., on behalf of the defendant, submitted that as a matter of correct law the plaintiff could not recover in the action. Counsel argued that the plaintiff could not go behind the bill and sue for a debt, because while the bill was current that was suspended, and the bill had never been dishonoured. Further, the bill was barred by the Statute of Limitations.

Mr. Justice Bailhache: Do you press the defence of the Statute of Limitations?

Mr. Schiller: Yes, I am bound to say that I do.

Mr. Schiller went on to remark that everybody knew when Mr. West was brought into these transactions he had no means then to meet the liability, but he said he would make arrangements for bearing his share and being able to make good account within a certain time, and the plaintiff's answer to this attitude had been the issuing of a writ.

Counsel was not prepared at the moment to say what the defendant would do now that the action had been pressed against him, but he had always been willing to agree to any reasonable arrangement to meet his liability. Mr. Schiller added that the defendant was a guarantor for the company, and, of course, he had had no benefit from the money which had gone to the company.

Mr. Justice Bailhache: Well! nor has the plaintiff.

His Lordship said he was bound to have regard to the defence of the Statute of Limitations and there must be judgment for the defendant with costs. His Lordship added—"I hope if he (the defendant) is able to pay he will, as it seems to me to be a case where he should do so if he can."

Mr. Schiller said he desired to say now that judgment had been entered for his client, that Mr. West intended to shoulder his fair share of the responsibility.

Mr. Justice Bailhache: Yes, I think it is quite right that he should do so.

Allis Chalmers Co. v. The Fidelity and Deposit Co., of Maryland.

In the Court of Appeal on March 12th and 13th, before Lord Sumner, Lord Justice Kennedy, and Mr. Justice Lawrence, this case was heard on the appeal of the defendant company, against a judgment of Mr. Justice Phillimore. The plaintiff company, manufacturers of electrical machinery, carrying on business in the United States, London, Paris, and elsewhere, brought the action claiming a declaration that a fidelity guarantee bond for £1,000 given by the defendant company was a valid and subsisting bond, and that that company was liable to pay thereunder in respect of a loss incurred by the plaintiff company by the defalcations of one A. C. Lochenies, the manager of its Paris office. In December, 1911, negotiations were opened between the parties for insuring the plaintiff company against acts of dishonesty on the part of Lochenies, and an application form was forwarded to them in which, in answer to a question asking from what date the bond was to be in force, and for what amount, the reply was given "From issuance, £1,000." On March 8th, 1912, the bond was duly drawn up, and executed at the defendant company's London office. The premium was to be £6 5s., and the bond was to cover losses within the limits of the amount insured for "during the period from March 8th, 1912, to March 7th, 1913." The premium had not then been paid, nor by the terms of the bond was payment of the premium made a condition precedent to liability upon it, but the document was forwarded that day to the company's French agents, who on March 9th sent it to the plaintiff company's Paris office. The bond was returned by the agent with a request that the defendant company would deliver it at the plaintiff company's London office. This was done on March 18th, with a letter asking for a cheque in exchange for the bond. But as Mr. Keen, the manager of the plaintiffs' London office (who was in control of the European business) was absent in America at the time, it was arranged that the matter should stand over pending his return about April 18th, and the bond remained in a drawer in the defendant company's office. Up to April, 1912, Lochenies had enjoyed an unblemished reputation for honesty and ability, though it was thought desirable to insure him because of the large sums of money passing through his hands. On April 13th, however, he left the Paris office, stating that he was going to the South of France on the plaintiff company's business. He never returned. On April 16th the London office became aware of his absence, and by April 18th were admittedly in a state of anxiety and suspicion, though not sure that his absence was incapable of satisfactory explanation. On that day Mr. Keen returned from America, and he being informed of the facts, sent to the defendant company's London office a messenger, who paid the premium, and brought back the bond in exchange. A few days after the plaintiff company discovered, it was said, defalcations estimated at about £11,000. Claim was thereupon made on the defendant company, which repudiated liability under the bond on the ground that the contract of insurance was not completed till April 18th, and that there had been concealment of material facts. The plaintiff company, on the other hand, while admitting that they could not recover if the contract was not completed till April 18th, maintained that it was concluded on March 9th, or alternatively on March 18th, at which time there was nothing to conceal. At the trial Mr. Justice Phillimore held that the defendant company was liable to pay under the bond, as the date of "issuance" was at the latest March 18th, a date when it was not suggested that the misconduct of Lochenies had begun. He accordingly gave judgment for the plaintiff company, granting the declaration asked for.

Mr. Sanderson, K.C., Mr. McCardie and Mr. E. L. Barnes appeared for the appellant company; and Mr. Sankey, K.C., and Mr. Barnard Lailey for the respondent company.

In support of the appeal, Mr. Sanderson argued that the matter of the bond was only in a state of negotiation till April 18th, when the premium was paid and the bond was handed over.

Mr. Barnes, following on the same side, contended that there was no evidence of any agreement or offer by Mr. Keen prior to April 18th to accept the bond. He further suggested that the correspondence showed that the matter, which was allowed to remain open, was the matter of the insurance, and not the mere payment of the premium.

Mr. Sankey, K.C., for the respondent company, supporting the judgment of the Court below, said that his contention was that by March 9th a contract of insurance had been concluded for a risk to attach from March 8th, the date of "issuance." If he were wrong in that proposition, then he submitted the contract was concluded by March 18th, when application was made to the plaintiff company's London office for the payment of the premium, and the matter of payment stood over till the return of Mr. Keen from America.

Lord Sumner asked if "issuance" was completed when the bond still remained in the possession of the defendant company.

Mr. Sankey said that was his submission, though, having regard to the facts of this case, it was not necessary to go as far as that.

Lord Justice Kennedy thought that the question was whether the defendant company had done its best in the way intended by both parties to put the bond out of its possession and into the possession of the plaintiff company. Leaving it on a desk or giving it to a servant was not taking any steps to put it out of one's possession.

Mr. Sankey argued that it was sufficient to fix the date. It was only the question of the payment of the premium that remained open.

Mr. Barnard Lailey, taking up the argument for the respondents, contended that there was a concluded contract, operating from some date before April 18th, binding the plaintiff company, on the one hand, to pay the premium, and binding the defendant company, on the other, to give protection.

Mr. Sanderson, in reply, said that the obvious construction of "issuance" was that it was intended that the insurance contract should not be in force until the actual bond was handed over. Until it was handed over, it was open to either party to withdraw.

Their Lordships reserved judgment.

Successful Appeal by the London Electric Railway Co.

The London Electric Railway Co. and Mr. Hunkley, a builder, were the appellants before the Lord Chief Justice and Lords Justices Swinfen Eady and Phillimore, in the Court of Appeal on Thursday (March 12th) from a judgment entered against them by Mr. Justice Scrutton, following the verdict of the jury in the King's Bench Division in favour of Miss Florence Hurlestone.

Mr. Rosskill, K.C., who appeared for the appellants, said the lady was awarded damages amounting to £75 for personal injuries received, but the question for the decision of the Court was of great importance to the Railway Co. It appeared that the builder obtained a contract to build premises over the entrance to a tube station in Cranborne Street, and while those operations were in progress a piece of wood fell on the head of Miss Hurlestone who was walking along the pavement.

After argument, the Court allowed the appeal, with costs, the Lord Chief Justice remarking that the circumstances revealed the fact that the Railway Co. were the reversioners of the building to the builder, and no authority had been read in which reversioners had been held liable for the negligence of the lessee. Then it had been argued that the Railway Co. had caused a dangerous building to be erected, and that being so, they could not shelve their responsibility because an independent contractor did the work. It was not the Railway Co. that caused the work to be done but the building lessee, and the latter was therefore liable for any accident due to negligence.

Lords Justices Swinfen Eady and Phillimore agreed.

Postmaster-General *v.* Miller.

At the Salford County Court on Monday, Judge Stanger heard a case in which the Postmaster-General claimed £6, a year's fees for the use of a telephone, from Fredk. V. Miller, of Browning Street, Salford.

After hearing the evidence, his Honour said it would have been very much better if the practice were adopted of fixing the telephone only after the year's fee had been paid. The Post Office were claiming a year's fee in this case after only five weeks' use of the telephone. Though the agreement was signed on September 26th, it was not till November 27th that the telephone was ready for use, and the defendant had meanwhile written to complain that he would have to have the wires removed unless the instrument was put up. Commenting on this delay, the Judge said he thought the defendant would have been quite justified in cancelling the contract on the ground of unreasonable delay. He had accepted the telephone, however, and was therefore bound to pay. The unfortunate part was that, at the outset, the defendant had actually offered to pay for a year's use, but the money not being then due, was not accepted. Meanwhile his circumstances had so changed that he had not only no further use for the instrument, but was unable to pay at once the £6 demanded. According to the terms of their contract, the Post Office had meanwhile disconnected the wires.

An agent for the Postmaster-General said that if the defendant had gone to the Post Office and explained the circumstances, some exception might have been made in his case.

His Honour said that, although he was obliged to give judgment, he would make the terms as lenient as he possibly could. He ordered the defendant to pay £1 within six months and the remainder at 1s. per month.

BUSINESS NOTES.

Thermit Welding.—Messrs. Thermit, Ltd., inform us that they have contracts in hand, or shortly to be commenced, for welding at the following places:—

Bolton, Burnley, Bradford, Bournemouth, Brighton, Dublin, Manchester, Liverpool, Salford, London County Council, London United Tramways, Sheffield, Southend, Rotherham, Northampton, Nottingham, Huddersfield, Shipley, Warrington, &c.

During 1913 the number of joints welded in the United Kingdom amounted to nearly 17,000, and the number welded throughout the world over 108,000.

Bankruptcy Proceedings.—Frank West Suter, electrical, &c., engineer, 67, St. John's Park, Upper Holloway.—An application for an order of discharge was made last week to Mr. Registrar Linklater, at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the debtor filed his petition in December, 1913, with provable claim, £6,428; no assets were disclosed, but a small bank balance of 1s. 3d. had been collected. The debtor had stated that in 1908 he and two others who had traded in partnership as Frank Suter & Co., transferred their business which was carried on at 66, Berners Street, W., to a company registered as "Frank Suter & Co., Ltd.," of which he acted as managing director at a weekly salary of £5, subsequently increased to £7. In 1909 the debtor and two others formed a company registered as "Suter's Patents, Ltd.," of which he acted as engineer at the date of the receiving order. He attributed his failure and insolvency to his liability on the debentures issued to Frank Suter & Co., Ltd., he having guaranteed repayment of bonds to the extent of £6,000 in the company. The discharge was suspended for two years.

Charles Lewis, "electrical engineer, lately licensed victualler," Manchester. Trustee, Mr. J. G. Gibson, Bryom Street, Manchester, released February 16th.

The Stolz Electrophone Co., Ltd.—First meetings of creditors and contributories will be held on March 24th, at Carey Street, W.C.

W. R. Wedge, electrical engineer, The Arcade, Northampton.—This debtor should have attended at the County Hall, Northampton, on March 10th, for his adjourned public examination, but the Official Receiver stated that he had received a letter from the debtor who was living at Bury, Lancs., and he gathered that debtor could not afford to come to Northampton. He could not agree to the examination being closed because he believed the statement of affairs and the deficiency account were all wrong. If at any time the debtor was coming to Northampton he could apply for the case to be reopened. It seemed idle to keep it about month after month, and he applied for an adjournment *sine die*. The examination was again adjourned.

W. Wadsworth, electrical agent and dealer in electrical accessories, Manchester.—Trustee (Mr. J. G. Gibson, Byron Street, Manchester) released February 16th.

Our Cape Town correspondent says:—The *Union Gazette*, published in the week preceding the departure of the mail, contained notices of surrender of following estates as insolvent:—Walter Green, trading as W. Green & Co., electrical engineers, 48, Queen Street, Port Elizabeth; Marc Justus Brookhurst, electrician, of Oudtshoorn.

A Useful Testimonial.—The following unsolicited testimonial is of interest, and should prove of assistance to electrical contractors in aggressively pushing electrical driving for all industrial purposes:—

"As it is now over 12 months since I had one of your 18-H.P. motors installed at my works (the Southend Machine Joinery Works), I feel it is only due to you to let you know that I am more than satisfied with its working, both in output and economy. It seems to me there is no comparison in the saving from first to last as against gas engines, besides which the motor is so clean and takes up no room, and expense for oil is almost nil. You can make what use you like of this because I am sure it is only by giving the results of practical tests that outsiders will be taught the possibilities of the up-to-date motor.

"(Signed) John C. Beale."

The motor in question was made by the British Thomson-Houston Co., Ltd., of Rugby.

Electric Cable Manufacture in Spain.—As was briefly mentioned in a recent issue, the Spanish branch of Messrs. Pirelli & Co., whose works are at Villanueva y Geltru, have recently acquired 20,000 sq. m. of additional land adjacent to their factory. We learn that contracts have now been placed for the erection of two armoured-cement buildings, having an area of about 5,600 sq. m. One will be used as an extension of the company's cable-making plant, while the other will be devoted to the manufacture of new classes of rubber goods, of which the Pirelli Co. are making a speciality. It is stated that so far as electric cables are concerned, only those intended for telephonic purposes need now be imported into Spain.

China.—We have received a photographic reproduction of a Chinese almanac, in the design of which are recognised such familiar lines as an "Osram" lamp, "Freezor" fan, a "Magnet" kettle, &c., all of which go to show that it is a publication of the General Electric Co. of China, Ltd., on behalf of their Chinese friends. The original production is printed in a number of colours, and in such a way as to make a suitable appeal to the Chinese mind.

Condensing Plant Contracts.—The Mirrlees Watson Co., Ltd., have recently received orders for condensing plant for the following:—

Leeds Corporation, per Messrs. Willans & Robinson, Ltd.; Haunchwood Colliery and Griff Colliery, per Messrs. Greenwood & Batley, Ltd.; Millom and Askam, Hematite Iron Co., Ltd., per Messrs. Fraser & Chalmers, Ltd.; Langwith Colliery; Enfield Lock, per Messrs. Jas. Howden & Co., Ltd.; Burgh of Kilmarnock, and others.

New Accumulator.—A new non-lead accumulator, known as the "Lux," is attracting attention in electrical circles in Austria. It has been introduced by the Lux Licht Gesellschaft, of Vienna.

Catalogues and Lists.—The Parsons Motor Co., Ltd., Town Quay, Southampton.—76-page illustrated catalogue containing very full descriptive matter regarding their marine and stationary engines, including small petrol and paraffin-electric sets, paraffin engine electric welding sets, motor-van with electric welding equipment, &c. A second publication, of 40 pages, contains an interesting collection of pictures of the various craft into which the firm's installation have been put.

The Edison and Swan United Electric Light Co., Ltd., Ponder's End.—Leaflet No. 3,022 gives some particulars with illustrations and prices of the Ediswan domestic pattern electric flat-iron.

Allgemeine Elektricitats-Gesellschaft, Berlin.—Brochures, admirably illustrated, describing manufacture and adjustment of the A.E.G. supply meters, of which the second million was completed last December, and electric clock installations; also leaflets relating to electrically-driven machine tools and pumps, controllers, regulators, half-watt automobile lamps, and electric floor-polishers.

Schniewindt Electric Co., 40 and 41, Staniforth Street, Birmingham.—A collection of seven leaflets illustrating and giving information and prices respecting their asbestos woven net resistances, electric heating sets, various types of made-up resistances, "Triumph" heating and cooking apparatus, and "Peerless" pipe-cutting pliers and wall-boring tools.

Messrs. Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—Some hints to electricity users issued by the firm give two inducements to the recipient to preserve same—a loop for hanging and a small set of monthly date slips for the year.

Dissolutions and Liquidations. — Grindell-Matthews Wireless Telephone Syndicate, Ltd., Broad Street House, New Broad Street, E.C.—Meetings of the creditors and shareholders were held on March 10th at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. Mr. H. E. Burgess, Official Receiver, reported that the company was formed in April, 1910, with a nominal capital of £20,000, subsequently increased to £25,000, the object being to acquire, develop and deal with a wireless telephone invention of Mr. H. Grindell-Matthews. The vendors, Messrs. Rouse, Poole & Co., had previously obtained the patents from the inventor for £6,600, which was satisfied by a cash payment of £1,000 and shares to the face value of £5,600. They passed on the option to the company for £13,333, payable as to £1,333 in cash and £12,000 in shares. It was not clear, remarked the Official Receiver, what had been done by the vendors to justify the doubling of the original price paid for the patents, because what work had been expended upon them had been performed by Mr. Grindell-Matthews. A prospectus was issued in April, 1910, in response to which applications were received for 10,569 shares of £1 each, which, with the issue of 12,000 vendors' shares, made a total allotment of 22,569 shares out of the authorised issued of £25,000. Some of the shares were issued at premiums ranging from 3s. to 10s., and in that way the company received an additional £535, but a portion of that amount was paid away as commissions for obtaining subscriptions. The company thus had a working capital of £10,000, after payment of the £1,000 cash portion of the purchase consideration, and the whole of the money had been expended in perfecting and exploiting the invention. A substantial sum had been paid for advertising it, and having regard to the fact that the patents were even now regarded as possessing substantial value, it was quite possible that the sum so expended could have been included in the item of goodwill. The operations had included the erection of stations at Letchworth and Northampton, which were about 40 miles distant from each other, and it was reported that communications between those two stations could be carried on with perfect ease. The capital subscribed by the public not having been sufficient, debentures for £2,500 were issued, and recently Mr. T. D'Arcy Cooper, C.A., George Street, Mansion House, E.C., was appointed as Receiver on behalf of the bondholders and took possession of all the assets. They included the patents, the workshops, and all equipments, the total value of which appeared in the liquidation accounts filed by the directors at £31,000. The liabilities, apart from the debentures, amounted to about £3,500, consequently the realisation should provide not only sufficient to discharge all the debts, but a substantial return to the shareholders. The failure of the company was attributed by its officials to the fact that the completion of the work to perfect the invention occupied much longer time and involved a greater expense than was originally contemplated or provided for; there was consequently a shortness of capital with which to enable the company to meet pressing liabilities and to dispose of the invention when it had been brought to a commercial stage.

Mr. Pitts, the secretary of the company, in moving the appointment of Mr. Wm. McEwen, C.A., to the post of liquidator, stated that negotiations were pending for a reconstruction of the company on lines that would be distinctly beneficial to all concerned. Not only would the debts be paid in full, but the interests of the shareholders would be protected. A gentleman had come forward with an offer of £3,600 for the property, and had paid a deposit of £360 to the Receiver for the debenture-holders. The idea was to promote a new company to deal with the invention after payment of the old company's debts, and to give the old shareholders a substantial interest in the new concern.

A resolution was unanimously passed by the creditors for Mr. McEwan, C.A., to fill the post of liquidator.

The shareholders, at the subsequent meeting, nominated Mr. Harry Wilson, I.A., for the post, and expressed the opinion that any reconstruction negotiations ought to be entrusted to a gentleman who was totally independent of the old board.

Mr. Pitts pointed out that the directors had at heart the best interests of the shareholders, as was shown by the fact that they had given their services for three years without asking for, or receiving, one penny in the shape of remuneration. The gentleman who had deposited the £360 on the purchase of the property was thoroughly desirous of acting in the best interests of those people who had invested money in the company, but if the shareholders chose to act in direct antagonism to him and the board, it was clear that the directors would take no further interest in the matter, and the sale would go through without any benefit to the shareholders generally.

After a long and somewhat acrimonious discussion, Mr. McEwan was also nominated as liquidator, and, upon a vote being taken, the chairman declared that his election had been carried by a substantial majority of the shareholders. There was accordingly a difference of opinion between the creditors and the shareholders, and the facts would be reported to Mr. Registrar Manson, by whom the appointment would be made in due course. In the meantime, he would appeal to the two opposing sections to smother all feelings of resentment, and combine with a view to a reconstruction of the company and the welfare of all interested in the concern.

As the result of the suggestion, a committee of inspection was formed consisting of three shareholders, at whose request Mr. Pitts consented to also join as a member. Appended is a list of the principal unsecured creditors:—

Brown, S. G.	£25	Phillips & Leigh	£35
Butt, Fredk. R., & Co.	12	Pitts, F. C.	236
Bull, Sir Wm.	73	Poncon, S. P.	33
Cossor, A. C.	120	Pool, F. R.	428
Crompton & Co.	279	Piggott Bros. & Co.	51
Cameron, J.	165	Pullen & Sons, J. G.	156
Mitcham, W. T.	39	Regent Carriage Co.	88
Frankland, Sir Fredk.	275	Robinson, F.	72
Grant, Capt. R. A.	100	Spurling, D.	188
Henke, H.	32	Spa Property Co.	131
Matthews, H. Grindell	824	Whittaker, H. A.	34
Mogridge, B. W. L.	16	Capital and Counties Bank	19
Openshaw & Co.	18		

Hotton & Co., Ltd., 71, Southwark Street, S.E.—Under this compulsory liquidation, the report of Mr. H. E. Burgess, Official Receiver and Liquidator, has been issued to the creditors and shareholders. The accounts filed under the liquidation show liabilities £3,812, against assets valued at £1,265, and a deficiency of £7,098 as regards contributories. The company was registered as a private company on October 20th, 1910, with a nominal capital of £6,000, divided into 4,500 ordinary and 1,500 preference shares, all of £1 each. Its objects were to acquire the lighting engineering business carried on at 21, Charterhouse Buildings, E.C., by William Hotton under the style of the Hotton Lighting Co. In September, 1913, debentures for £1,082 were issued to secure previous advances, and in the following November Mr. F. W. Stephens was appointed Receiver for the bondholders. The Receiver is not carrying on the business, and it is doubtful if there will be any substantial surplus from his realisations. The question of a dividend to unsecured creditors will, therefore, depend upon the validity or otherwise of the debenture charge.

Perfectophone Co., Ltd.—A meeting will be held at the offices of Messrs. Greenhalgh, Sharp & Co., 30, Brown Street, Manchester, to hear an account of the winding up from Mr. W. Adgie (joint liquidator).

Trade Announcements.—The Harland Engineering Co. have removed to larger premises at 196, Greengate, Salford, Manchester, where they have erected new premises, comprising head offices, works and stores.

On March 30th, for the convenience of their West End friends, the Adnil Electric Co., Ltd., are opening a depôt at 25, Victoria Street, S.W., under the management of Mr. W. A. Davis. Firms interested in electrical goods are invited to inspect their showroom at that address, with its stock of samples of the firm's manufactures.

The Pendreich Electrical Firm, 250-251, Dalry Road, Edinburgh, have been appointed sole agents for the Eastern Counties of Scotland by the following firms:—Acton Lamp Co., Ltd., Berry, Skinner & Co., Mickelwright, Ltd., Lionel Robinson, and Steel Tubes and Conduits Co.

Mr. George Ellison, of Birmingham, announces that he has appointed Messrs. Kelsall & Parsons, Caledonian Chambers, 87, Union Street, Glasgow, as his Scotland representative, and also Mr. A. B. Gott, Independent Buildings, Fargate, Sheffield, as his representative for South Yorkshire, Nottinghamshire and Derbyshire.

A partnership has been entered into by Mr. Wm. B. Robertson-Garlick, late assistant engineer under Mr. Albion T. Snell, M.I.C.E., to the Festival of Empire authorities, and Walter Edward King, late of Barnet. The business, which covers all classes of electrical contracting work, is being conducted from 82, Lamb's Conduit Street, W.C.

Mr. Geo. Morrison has removed his business from 4, Birley Street, to more extensive premises at 24, Birley Street, Blackpool.

Mr. L. H. Euler is removing to 3, Broad Street Buildings, E.C.

Mr. Humphrey Wood, who has represented Messrs. Marsh, Son & Co., Ltd., for the past 11 years, has now joined in partnership with Mr. James M. Douglas in the Accessories Manufacturing Co., at 11, Dean Street, Oxford Street, W.

For Sale.—Halifax Corporation Tramways and Electricity Committee has for sale, by tender (April 3rd), one 30 ft. × 9 ft. Lancashire boiler. Particulars of which are given in our advertisement pages to-day.

Netherlands Exhibition.—An Electrical Exhibition is to be held at Deventer, from June 24th to July 8th, on the occasion of the opening of the Yssel Electric Power Station, which will provide the towns of Zwolle, Deventer and Zutphen and the neighbouring villages with electric light and power. The object is to acquaint the population likely to use electric light or power with its advantages, and to render them familiar with the various electrical appliances and their use. The British Consul at Amsterdam advises United Kingdom manufacturers of lamps, motors, accessories, &c., who are represented in the Netherlands, to hire a small stand or space to show their goods. Foreign exhibits will be gladly received and will receive fair treatment. Applications for space must be lodged before May 15th. Some further particulars may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C., or at the Exhibitions Branch of the Board of Trade, Westminster, S.W.

LIGHTING and POWER NOTES.

Ardee.—Proposed E.L.—On the Town Commissioners dividing on the question of public lighting, three voted for electricity and three for gas, and, as the chairman declined to vote, the matter has been adjourned.

Argentina.—The works of the Tucuman Hydro-Electric Co. were almost entirely destroyed by the floods last month. The damage is estimated at $1,000,000.—*Review of the River Plate.*

Ashton.—The Health Committee has considered the sterilisation of milk by electricity, and has appointed a Sub-Committee to obtain information as to the Liverpool Corporation's installation.

Barmborough (near Doncaster).—Proposed E.L.—The P.C. is considering the question of having the parish lighted by electricity.

Batley.—Loan Sanction.—The Corporation has received the sanction of the L.G.B. to the borrowing of £8,206, which has been overspent on electric mains, services, meters and arc lighting.

Bury St. Edmunds.—New Battery.—The Electricity Committee has recommended the T.C. to obtain a new storage battery at an estimated cost of £750, and the engineer has been instructed to obtain tenders for the same.

Canada.—The Calgary Council has decided to borrow $600,000 for the improvement of its E.L. equipment.

The Prince Rupert Council is to carry out a $300,000 hydro-electric scheme.

Along the new railway route to Hudson Bay it is calculated that 11 rapids on the Nelson River would furnish 6,800,000 H.P. Three rapids are each estimated to give about a million H.P.

The Welland Canal scheme is expected to generate 224,000 H.P. in addition to the 106,000 H.P. which private interests claim to be able to obtain at the falls.

Clogheen (Munster).—Public Lighting.—At the R.D.C. meeting last week it was stated that a local merchant was investing £1,000 in an electric generating plant, and his offer to supply energy to 50-C.P. street lamps at 30s. each per annum on a ten years' agreement was accepted.

Clun (Salop).—Proposed E.L.—A scheme under consideration for introducing E.L. in the district proposes that Mr. Simons, electrical engineer, of London, shall install the plant, and that a company be formed to take over the concern.

Derby.—New Plant.—The T.C. has decided to obtain new electrical plant as follows:—Turbine plant, £7,290; foundations and flooring, £400; piping, £250; condensing water screen, £300; boiler, brickwork and piping, £2,400; motor and generator, £1,900. It was stated that a saving of £3,000 per year would be effected by the use of the larger turbines.

Douglas.—Promenade Lighting.—A scheme for the decorative illumination of the whole of the seafront by means of electricity has been approved by the authorities, and it is intended that the scheme shall be available by June.

Dublin.—Street Lighting.—A system of centrally suspended electric lamps in some of the streets is to be introduced. The new system is mainly intended for smaller streets where lamp standards might cause inconvenience to traffic.

The Corporation has been granted a locus to oppose the Alliance and Dublin Consumers' Gas (Electricity) Bill.

Durham.—Proposed E.L.—A joint meeting of representatives of the Coxhoe, Cassop and Kelloe parish councils has resolved that the County of Durham E.P.S. Co. be also asked to quote for the E.L. of Cassop, Quarington Hill and Kelloe.

Easington.—Workhouse Lighting.—The B. of G. has appointed a Committee to consider the question of lighting the workhouse and offices by electricity.

Fareham.—As the estimates of the U.D.C. electricity undertaking for the past year, show a deficit of £100, and the estimates for the year ended March 31st, 1915, a further deficit of £250, the Council has decided to increase the price of electricity for private lighting from 6d. to 7d. per unit. The Lighting Committee has deferred the question of public lighting in Catisfield, with a view to considering an electric lighting scheme.

Finland.—Arrangements are in hand for the establishment of a large generating station for the supply of electricity to the sawmills in Riihimaki.

Galashiels.—Prov. Order.—The T.C. has decided to withdraw its opposition to the proposed prov. order of the Galashiels and District E.L. Co., on the conditions that the maximum price is reduced from 13s. 4d. for the first 20 units and 6d. per unit after to 10s. and 4d. respectively and that other protective clauses are inserted. It is stated that the various points have been conceded.

Hove.—The T.C. has decided to arrange for the working of the E.L. undertaking, taken over from the company, "assuming that no other arrangements are made in the meanwhile."

Huddersfield.—The Electricity Committee has informed the Newmill U.D.C. that it cannot see its way to carry out the proposed extension of the mains to Newmill at present.

Inverurie.—Proposed E.L.—The G. N. of Scotland Railway Co., in reply to the application of the T.C. for a supply of electricity, stated that it would prefer to supply the current in bulk, and that the distribution should be carried out by the Council. At present it is proposed to light the streets and public buildings by electricity.

Listowel (Co. Kerry).—Electric Pumping.—The U.D.C. has accepted the tender of the Listowel Electric Lighting Co. to supply 100,000 gallons of water per day for the reservoir, at £247 per annum. The company is to provide an independent plant.

London.—Half-Watt Lamps.—The Kensington B.C. has decided to fix two half-watt lamps in the High Street as an experiment, with a view to extending the system if it proves satisfactory. The St. Pancras B.C. has been recommended by its Electricity Committee to install nine half-watt lamps for experimental purposes.

Marylebone.—The Public Health Committee has accepted the tender of the Electricity Department for converting the heating arrangements at Barrett Street convenience from gas to electricity. The Medical Officer of Health has reported that the installations already made have given satisfaction, and that the cost of electric heating is slightly less than that of gas.

Maidstone.—Mill Driving.—The coating paper mill of Messrs. A. E. Reed & Co., Ltd., one of eight owned by the same firm, were burnt to the ground in August last. This has since been entirely rebuilt, and the whole of the motors and controlling appliances were supplied by the Langdon-Davies Motor Co. The motors have a speed variation of from 500 to 1,200 R.P.M., thereby giving complete control over the drying process for the paper. The original method of driving was by belt transmission from the main engine, by which means it was impossible to get the proper speed at the various changes of the atmosphere for drying the paper. The electrical installation is giving great satisfaction to the management, both in utility and running cost, the saving of the cost of the large belts being a marked feature in the adoption of electrical power.

Midhurst.—E.L. Scheme.—The Governors of the Grammar School have consented to withdraw their opposition to the establishment of electricity works near the school by a company, providing it is not within 100 yd. and that silencers are fitted to the engines.

Newport.—The borough electrical engineer reports that during the past month the erection of the 600-KW. motor-generator set was completed, and that on most days and through a greater portion of the day (now that that plant was installed) the department was able to shut down all the reciprocating plant and put the whole of the supply on to the turbine.

Reading.—The T.C. has appointed a Committee to confer with the Electric Supply Co., with respect to the prov. order being sought to empower the company to supply electricity in bulk to the York Town and Blackwater Gas Co., and to which the Corporation has objected.

Slaithwaite (Yorkshire).—The U.D.C. has received from the B. of T. a copy of an order proposed to be issued conferring on the Council powers with regard to E.L. It was decided to ask for the maximum price to be fixed at 6d. instead of 8d. per unit, and for certain clauses to be deleted from the order.

South Africa.—Ladysmith (Cape Province).—A ballot of municipal ratepayers has resulted in favour of the proposed loan of £7,000 for an electric lighting scheme.

Staines.—Prov. Order.—The R.D.C. has consented to the proposed Feltham and District E.L. Order, subject to certain modifications as to the length of mains to be laid.

Street (Somerset).—E.L. Scheme.—The U.D.C. has decided that in the event of an electric light company being formed, the public lighting will be handed over to it. Mr. F. Christy has informed the Council that a local company could be formed conditionally upon obtaining the public lighting contract. It is estimated that the conversion from gas to electric lighting would save £30 per annum.

Swanage.—The Electricity Supply Co. has decided to extend its mains to the Swanage Bay Estate, which is being developed.

Swansea.—Rate Relief.—The question of allocating electricity profits to rate relief was discussed recently by the Finance Committee (see page 311) which, despite the opposition to its proposals, has decided to recommend the T.C. to allocate £2,200 out of the profits for this purpose. The net profits for the year just ending are expected to be £2,500, and increased capital charges will be incurred next year. The borough treasurer supports the recommendation with the plea that the undertaking is better placed than many similar undertakings.

Swindon.—Annual Estimates.—The estimates for the ensuing year provide for a revenue in the electricity department of £12,290, as against £12,328 last year.

Truro.—E.L. Scheme.—The E.L. Committee has presented to the T.C. the report of the deputation which visited Launceston and Falmouth to ascertain particulars of the electric light undertakings. Consideration has been given to a letter from Dr. Purves. It was resolved that, having regard to the alteration in the site and mains, Dr. Purves be instructed to prepare an amended scheme and detailed estimate.

Virginia (Co. Cavan).—L.G.B. Inquiry.—An inquiry is to be held on the 31st inst. in connection with the proposed public lighting of the town.

Waterford.—B. of T. Inquiry.—Last Friday, Mr. G. B. Deane held an inquiry into the application of the Corporation for a prov. order for E.L. The scheme is estimated to cost £30,000.

Whitstable.—The U.D.C. has given Mr. F. Broad permission to erect overhead wires over Argyle Road for the purpose of supplying electricity to business premises in the district.

Wolverhampton.—Rate Relief.—From the profits of the electricity undertaking £2,125 is to be transferred to the borough improvement fund.

Woodford.—Proposed E.L.—The U.D.C. has decided not to proceed with the agreement with the Walthamstow U.D.C. for a supply of electricity. The prevailing opinion is that the Council should have its own independent supply.

York.—The T.C. has decided, as soon as it obtains the powers, to extend the supply of electricity to the Strensall, Poppleton and Haxy districts.

TRAMWAY and RAILWAY NOTES.

Canada.—The Toronto Suburban Railway Co. has awarded a contract to the Canadian General Electric Co., for sub-station apparatus and car equipments, for the new line from Toronto to Berlin. This will be the first interurban line in Canada to operate at 1,500 volts D.C. The catenary type of overhead construction will be used, and there will be three sub-stations; 1,500-volt rotary converters, each of 500-KW. capacity, will be used, power being transmitted to the sub-stations at 25,000 volts. The cars will operate on a 600-volt line at approximately half normal speed; and changing from 1,500-volt to 600-volt trolley, or *vice versa*, will involve no loss of time in adjustment of control apparatus. The line with 1,500-volt operation will be about 62 miles long.—*Canadian Engineer.*

Continental Notes.—Germany.—A tunnel is to be constructed under the famous avenue Unter den Linden, in Berlin, in order to enable the tramways to cross it without marring the appearance.

The Saxon Government has sent several officials to London to study intra-mural transit systems with special regard to future developments in Dresden, where an electric railway in shallow subways is regarded as the only solution of the traffic difficulties; this scheme would involve a tube under the Elbe.

In order to relieve the congestion at the large main station in Hamburg, a proposal is to be embodied in the next Prussian Railway Budget for the electrification on the single-phase system of the suburban line to Bergedorf and Friedrichsruhe. The work is likely to be completed in two or three years, and will form an extension of the lines already electrified.

Trials of the new single-phase locomotives for the Berlin City and Ring Railways will commence within the next three months on the Dessau-Bitterfeld railway, but the actual work on the Berlin lines has scarcely commenced yet. There will be two generating stations, one in Berlin for emergencies and peak loads and one in the brown coal district, where the Prussian State Railways are purchasing mines; this distant station will carry most of the steady load. The estimates of capital cost are not likely to be exceeded.

Negotiations are proceeding for an extension of the electric service beyond Gross-Lichterfelde, the local authorities and land-development companies having declared themselves willing to share the capital cost and also the working losses for the first few years, as the district is not yet thickly populated. This line from Berlin to Gross-Lichterfelde was electrified some years ago on the D.C. system as an experiment.

The Kaiser is evincing a lively personal interest in the question of automatic signalling.

Austria.—Some particulars have just come to hand of a new petrol-electric road train, with which some trials are being made by a large brewery undertaking in Vienna. The train, which is intended for a total load of 30 tons, consists of six vehicles, each of which is self-propelled. The first vehicle consists of a self-moving generating plant, comprising a petrol engine of 150 H.P. and dynamo. The following vehicles are connected together by drawbars, and each is fitted with an electric motor geared to the road wheels, current being supplied by the dynamo on the forward vehicle. The trials are stated to have been very satisfactory, and it is reported that the military authorities have expressed their willingness to grant an annual subsidy to any firm adopting it.

The Karlsbad municipal authorities have decided to construct an electric railway from Buschtiehrad railway station to the Kaiser Park, the first section to Neubad being taken in hand this autumn. The capital, 1,400,000 kronen, has been raised.

Halifax.—The Tramways Committee is considering the extension of its tramway system to Elland.

Hove.—Railless Traction.—The Brighton Corporation has informed the Hove Corporation that the over-running system favoured by Hove is unsuitable to Brighton, owing to the necessity of crossing certain tramway tracks, and that as Brighton has decided upon the under-running system, the matter should be referred to arbitration.

Huddersfield.—Rate Relief.—The Tramways Committee has transferred £6,662 to the relief of rates.

Manchester.—A special correspondent, writing in the *Manchester Guardian* on Saturday, outlines a scheme for underground tramways in the centre of the city, and states that this subject will doubtless form one of the most interesting parts of the report which Mr. J. M. McElroy (Manchester Corporation tramways manager) will present in a few days upon the investigations which he has carried out into methods adopted in other cities for dealing with street traffic. The correspondent suggests a mile and a quarter subway, which would cost at least £300,000, and might run up to £500,000. Including the cost of dealing with sewers and street widening it is not unlikely (according to the writer of the article) that the total cost would exceed three-quarters of a million. He says the work seems to be worth the expenditure, and suggests that the soundness of the undertaking would not be seriously affected by utilising part of the accumulated reserve fund for this desirable improvement.

Stirling.—Proposed Tramway Electrification.—The T.C. has decided not to accept the offer of Mr. G. Balfour to take over the electricity works and convert the tramways to electric traction until it has obtained information as to the construction by the T.C. of a tramway system from Bridge of Allan to Bannockburn.

Swansea.—New Tramways.—The B. of T. has, after some demur, consented to the construction by the Corporation of the Mount Pleasant light railway, which will have one of the steepest gradients in the country.

Swindon.—Annual Estimates.—The estimated income for the ensuing year of the Corporation tramways department is £8,938, and the expenditure £10,551.

Wharfedale.—Railless Traction.—The Otley Council is supporting the proposal of the Leeds Corporation to extend its railless traction system to Wharfedale.

Westhoughton.—Suggested New Tramways.—The U.D.C. is considering the securing of a prov. order for the construction of tramways, efforts to induce the Bolton Corporation and the South Lancashire Tramways to carry out the work having proved abortive.

Wolverhampton.—Rate Relief.—It has been decided to transfer £3,777 from the profits of the tramways undertaking to the credit of the borough fund.

TELEGRAPH and TELEPHONE NOTES.

Cable Repairs.—The Anglo-American repairing c.s. *Telcania* had to seek shelter in Cork Harbour recently, being unable to continue her work in the Atlantic in consequence of the very heavy sea running.

Canada.—According to official statistics quoted by the *Canadian Electrical News*, for the year ending June 30th last, there are nine land telegraph companies operating in Canada, and

six cable companies, besides one wireless telegraph company. The total wire mileage on land is 152,919 miles, pole mileage 43,048 miles. The wire mileage has fallen from 167,939 in the previous year.

The telephone statistics show a marked increase in the use of the telephone. There is one telephone per 16·2 persons in Canada, and 1,075 organisations reported to the Government, besides over 100 from which reports were not received. There are 1,092,587 miles of wire in use, with 463,671 telephones, of which the majority are on central-battery systems. The capital outlay averages $129.13 per telephone.

France.—Much interest has been aroused by the discovery that a convention, known to but few members of the Chamber of Deputies, was signed in July, 1912, between the Department of Posts and Telegraphs and Mr. R. C. Galletti, entrusting to the latter the development of wireless communication with the French Colonies, and according him various privileges of great value. It is alleged that Mr. Galletti is the founder of an English company known as "Galletti's Wireless Telegraph and Telephone Co.," allied with the Indo-European Co., the Eastern Telegraph Co. and the Eastern Extension Telegraph Co., and that the convention secures the cable companies from effective competition on the part of the wireless service. It is further stated that the matter arises out of the opposition of the Department of Posts, Telegraphs and Telephones to the development of wireless telegraphy by the Colonial authorities, and it is alleged that this opposition is based upon the desire to protect the interests of the British cable companies in the East. An inquiry has been demanded, and the President of the French Budget Commission has, under the circumstances, ordered the matter to be referred back for reconsideration.

Germany.—The German Government has lately proposed to the Government of Sweden to lay a telephone cable from the German coast, at Sassnitz or Arcona or to the north of Zingst, to Trelleborg, in Sweden. The cable will be connected with the German telephone network, and new landlines will afford direct connection with Berlin and Hamburg.—*Zeit. für Schwachstromtechnik.*

On March 14th the messages sent out from Nauen during the daily experimental period were for the first time received at Windhuk, in Damaraland. Hitherto the remotest African station which could be reached was Dualla. The distance traversed by the message was about 6,500 miles, almost entirely overland.

The German Admiralty purpose erecting a wireless station at Pelzerhagen, near Neustadt, in Holstein. The site has already been acquired.

Imperial Wireless System.—On Friday last, at the first public sitting of the Select Committee of the House of Lords, Lord Halsbury, who had been elected chairman, decided that the charges against Lord Murray must be definitely formulated before evidence was called. On Tuesday the charges were presented to the Committee; they alleged that Lord Murray purchased shares regarding which he had special information derived from the managing director of the English Marconi Company, with which the Government of which he was a member was then negotiating a contract, and that those shares were at the time the property of the English company, and within a few days acquired a greatly increased value. A further charge related to the purchase by Lord Murray of British railway stock, for the Liberal Party, at a time when action that was being taken by the Government might have affected the value of the shares.

The Telewriter.—A telewriter exchange has been installed at the Manchester Royal Exchange, by means of which prices are transmitted from the telewriter exchange in Liverpool to the Exchange and other subscribers in Manchester.

The Telephone Service.—In addition to that at Epsom, there are now 11 other automatic exchanges in course of erection or on order. The largest, at Leeds, which will be opened early next year, will be built for 15,000, and equipped for 6,800 lines. The other towns where automatics are being installed are Accrington, Chepstow, Darlington, Dudley, Grimsby, Hereford, Newport (Mon.), Paisley and Portsmouth. Several new manual exchanges are being built in London, for 10,000 lines each.

Time Signals.—The Belgian Minister of Posts and Telegraphs has decided that all official clocks in Belgium in future shall be regulated at midnight by telegraphic messages transmitted from the Eiffel Tower.

Turkey.—The newly-installed telephone service in Constantinople was formally opened for general use on the 28th of last month, but was experimentally in operation from the 4th, when the first subscribers were enrolled. A difficulty of the undertaking has been the instruction of the staff of native women in the duties of telephone operators.

Wireless Telephony.—It is reported that Mr. Marconi, on board the Italian battleship *Augusta*, has succeeded in effecting clear communication with Rome, 300 miles away; Venice, at 600 miles; and Clifden, Ireland, more than 1,700 miles distant. The apparatus employed is said to be of a new and simple type, and the successful trials were conducted in the daytime.

The daily Press has made some sensational comments on the subject, such as the following extracted from the *Standard*:—

"The prophets have set themselves a new task in foretelling the date when all the magnificent new telephone exchanges, on which the Post Office is spending thousands of pounds, will become as antiquated as beacon fires, and their thousands of miles of wire lie as useless in the conduits as the lead in a Roman aqueduct. Already there is sign of alarm among those who are called upon to finance the installation of the present telephone system."

This is absurd; wireless telegraphy has not rendered telegraph wires unnecessary, and although wireless telephony will no doubt be of very great utility at sea, and between ship and shore, there is no reason to suppose that it will become commercially practicable in town service for very many years, if ever. Fortunately, the market appears to have been unaffected by the exaggerated reports that have been going about, for the *Westminster Gazette* on Wednesday said: "A fair amount of attention continues to be given to Marconis, but it is largely of the selling order, and the price is weaker."

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Newcastle.—April 29th. P.M.G. Electrically-controlled clocks at Post Office, Newcastle, N.S.W. Schedule No. 361. See "Official Notices" to-day.

April 21st. P.M.G. Telephone switchboards. Schedule No. 1,005. See "Official Notices" March 13th.

Bedford.—April 1st. Corporation. 12 months' supply of high and low-tension cables; one-phase A.C. induction house service meters; metal-filament lamps. See "Official Notices" March 13th.

Belgium.—April 14th. The Fonderie Royale de Canons, in Liége (80, Quai Saint Leonard). Supply and installation of the feeders and network of mains required in connection with the supply of current for lighting and power purposes at a number of the buildings at the Camp of Beverloo.

Blackpool.—March 25th. Corporation. For the supply of six new open bogie cars for the Tramways Committee. Particulars from Mr. C. Furness, General Manager, General Offices, West Caroline Street.

Bray.—April 7th. U.D.C. General stores and stores for electric light works. See "Official Notices" March 13th.

Bristol.—23 tons of boiler furnace castings for the electricity department. Particulars from Mr. H. Faraday Proctor, the Exchange, Corn Street.

Carlisle.—April 1st. Ironmongery, packing and jointing materials, oils, &c., for a year, for the Corporation Electricity Department. Mr. F. W. Purse, Electrical Engineer, Victoria Viaduct (returnable deposit of 5s. for each schedule).

Chesterfield.—Steam generating plant, switchgear and overhead crane, for the T.C. Mr. R. L. Acland, Electricity Works.

Devonport.—April 8th. 1,250-kw. turbo-alternator, with condensing plant, two 500-kw. rotary converters and switchgear, for the Borough Electricity Department. See "Official Notices" to-day.

Dublin.—March 30th. G.N.R. of Ireland. Re-plating of electric battery in connection with Hill of Howth electric tramway. See "Official Notices" March 13th.

Edinburgh.—March 28th. Arc lamp globes, pavement boxes and conduits, for the Electricity Supply Department for 12 months. Specifications, &c. (10s. for each specification), obtainable from Mr. F. A. Newington, Engineer, Electricity Supply Station, Dewar Place.

Egypt.—April 8th. Egyptian Ministry of Public Works. 45-kw. crude-oil electric generating set, switchboard, two electric pumps, four motors, overhead cable, &c., for a power station at the Khanka Sewage Farm. Copies of conditions and particulars (£3 1s. 7d., not returnable) from the Controller-General, Main Drainage Department, Cairo. Local representation. See *B. of T. Journal*.

France.—March 31st. French State Railway authorities (Service Electrique, 1re Division), Paris (43, Rue de Rome). Six electrically-operated cranes for service at the maritime station at Dieppe.

March 31st. French State Railway authorities (Service Electrique, 3me Division), Paris (72, Rue de Rome). Equipping 30 railway carriages with electric lighting and heating.

Glasgow.—April 7th. Twelve months' supply of stores, fuel, &c., for the Tramways Department. Specification from Mr. J. Dalrymple, General Manager, 46, Bath Street.

Halifax.—March 24th. Electrical fittings for six months, for the B. of G. Mr. A. T. Longbotham, Clerk, Carlton Street.

Huddersfield. — The Tramways Manager has been instructed to obtain tenders for the covering of 14 cars.

Kirkcaldy. — March 23rd. Corporation. Twelve months' supply of stores for the Electricity and Tramways Committee. Forms of tender from Mr. O. F. Francis, Burgh Electrical Engineer and Tramways Manager.

London.—L.C.C. Tenders are to be invited for the supply of machine tools, &c., for the boiler house workshop at the Greenwich generating station.

April 9th. Installation of 65 wiring points, 85 lights, and two power points, at Moxey Road centres, Woolwich. See "Official Notices" to-day.

HAMMERSMITH.—Tenders are to be invited by the B.C. for the supply of as much cable duct as may be required during the coming financial year.

Oldham.—March 23rd. Corporation. Steam, exhaust and drain pipes, condenser pipes, &c. See "Official Notices" March 13th.

Perth.—March 23rd. Corporation. Supply of 3,750 tons of small coal for electricity station. Form of tender from Mr. J. Lambert, Burgh Electrical Engineer.

Rawtenstall.—March 23rd. Corporation. Boilers, superheaters, mechanical stokers, and steam piping, for the electricity works. Mr. C. L. E. Stewart, Electrical and Tramway Engineer.

Salford.—March 23rd. Two high-tension distribution switchboards, for Park Lane sub-station, and twelve oil-switch cubicles for separate wall-mounting. See "Official Notices" March 6th.

March 23rd. Superheaters, pipes and valves. Specifications, &c., from the Borough Electrical Engineer, Frederick Road, Pendleton.

Swinton and Pendlebury.—March 26th. U.D.C. 12 months' supply of cable, joint-boxes, joint-box compound, bitumen, &c. See "Official Notices" March 6th.

Wallasey.—April 7th. Economisers, extra-high-tension cables, extra-high-tension switchboard, engines, alternators and condensers, hand-power overhead travelling crane, rotary converters, transformers, water-tube boilers, for the Borough Electricity Department. See "Official Notices" March 13th.

Warrington.—March 31st. 750-KW. rotary converter; E.H.T. switchboard panel, for Electricity and Tramways Committee. See "Official Notices" March 6th.

Watford.—March 24th. 14-B.H.P. electric motor, for the Guardians, Watford Union. See "Official Notices" March 13th.

Wimbledon. — March 27th. Corporation. Supply of four lines of 3-in. iron or stoneware conduits for E.H.T. cable; two ·15 sq. in. concentric, 11,000-volt, paper-insulated and lead-covered cables. Forms of tender from Mr. H. Tomlinson-Lee, Borough Electrical Engineer, Electricity Works, Durnsford Road.

CLOSED.

Australia.—QUEENSLAND.—P.M.G.'s Department :—

5 000 cordean insulators, £99.—John Fuller & Son, Ltd.
Fuses, lamp caps, indicators, strips, jacks, microphones, pole-hangers, generators, terminal strips, telephone sets, C.B. telephones and translators.—Western Electric Co. (Aus.), Ltd.
Resistance sounders, receivers, &c.—I.-R., G.-P. and Telegraph Works Co., Ltd.
Relays and sounders.—B.I. and Helsby Cables, Ltd.
30 C.B. cordless switchboards, four lines, £225; 35 ditto, six lines, £332; 20 ditto, ten lines, £485; and other telephone material.—G. Paton & Co.
550 Siemens standard receivers, £124; resistances, &c.—Siemens Bros. Dynamo Works, Ltd.

VICTORIAN RAILWAYS DEPARTMENT.—State Coal Mine :—

Two 10-H.P. motors, £56 each.—British G.E. Co., Ltd.

SHIRE OF TUNGAMAH (VIC.).—Cobram Electric Supply :—

Gas engine, £747.—R. Hornsby & Sons.
Electrical equipment, £1,801.—Sutherland & Ashman.
Cables, £435.—Steffens & Noelle.

SHIRE OF WARANGA (VIC.).—Rushworth Electric Supply :—

Gas engine and plant, £874.—R. Hornsby & Sons.
Dynamo booster, £119; storage battery, £771; erection of plant, £155; wires, cables, street-lighting fittings, &c., £483.—I.-R., G.-P. and Telegraph Works Co., Ltd.
Wire and cables.—Steffens & Noelle.—*Tenders.*

A contract for transformers for the City of Melbourne has been secured by Messrs. Johnson & Phillips, Ltd.

Belgium.—Three concerns submitted tenders last week to the municipal authorities of Liége for the supply and erection of a new 600-KW. steam engine and dynamo at the municipal central station, the lowest offer (£1,270) being that of the Société Internationale d'Electricité, of Liége.

Bolton.—A contract for the supply of traction-type tantalum lamps for the Corporation tramways for the ensuing 12 months has been placed with Messrs. Siemens Bros. Dynamo Works, Ltd.

Carlisle.—The T.C. has accepted the following tenders for additional plant :—

Oerlikon Co.—Turbo alternator and condensing plant, £4,908.
British Westinghouse Co., Ltd.—Rotary converters, £2,855; high-tension switchgear and second feeder panel, £975.

Dublin.—The Edison & Swan United E.L. Co., Ltd., has received the contract for the supply of Royal Ediswan lamps for the Dublin United Tramways Co., Ltd.

Glasgow.—The Tramways Committee recommends the acceptance of the following tenders :—

Steel rails and fishplates.—Bolckow, Vaughan & Co.
Steel drop forgings.—John M'Skimming.
Car brake gear.—Dryers, Ltd.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

ADMIRALTY—CONTRACT DEPARTMENT.

Brackets, pendants, &c.—Bulpitt & Sons, Ltd., Hayward, Tyler & Co., Ltd., General Electric Co., W. McGeoch & Co., Player & Mitchell, Ltd.
Circuit-breakers and contactors.—Whipp & Bourne.
Flashing lanterns.—General Electric Co., Ltd.

WAR OFFICE.

Dynamos.—Electric Construction Co., Ltd.
Installation of electric lighting, Royal Aircraft Factory, Farnborough.—Tredegar & Co.
Wiring of barrack blocks for electric lighting, Netheravon.—G. E. Taylor and Co.

INDIA OFFICE—STORE DEPARTMENT.

Cells.—Siemens Bros. & Co.

CROWN AGENTS FOR THE COLONIES.

Brake fittings.—Westinghouse Brake Co., Ltd.
Cable, &c.—B.I. & Helsby Cables, Ltd.
Electric light equipment.—J. Stone & Co., Ltd.
Telephones.—British L.M. Ericsson Manufacturing Co., Ltd.
Insulated wire.—Hooper's Telegraph & India-Rubber Works, Ltd.

H.M. OFFICE OF WORKS.

Electric wire and cable.—Armorduct Manufacturing Co., Ltd.

POST OFFICE.

Electric lifts (six), N.W. D.O. (London).—Medway's Safety Lift Co.
Laying lines of multiple-way ducts, Leeds—Castleford.—W. Irwin & Co.
Laying lines of multiple-way ducts and pipes, Leeds—Huddersfield (section 1). Robinson, Eckford & Co., Ltd.
Laying lines of multiple-way ducts and pipes, Regent's Park Road, N.W.—Scholey & Co., Ltd.
Laying lines of multiple-way ducts, pipes and U-shaped earthenware troughing, Liscard.—Jowett Bros.
Laying lines of pipes, Bradford.—W. Irwin & Co.
Laying lines of pipes, Dalkey, Killiney and Bray.—J. Ross & Son.
Laying lines of pipes, Dublin (N. and S. City).—J. Ross & Son.
Laying lines of pipes, Dublin, Blackrock and Drumcondra.—W. Dobson.
Laying lines of pipes and U-shaped earthenware troughing, Atherton.—W. Pollitt & Co., Ltd.
Laying lines of pipes, U-shaped earthenware troughing and lead-covered cable, Ilkley.—A. Schofield.
Manufacturing, supplying, drawing-in and jointing lead-covered cables, Swansea—Llanelly.—Johnson & Phillips, Ltd.
Manufacturing, supplying, drawing-in and jointing lead-covered cables, Swansea—Port Talbot.—Callender's Cable Co., Ltd.
Telephone exchange equipment, Birmingham (Central).—Western Electric Co., Ltd.
Telephone exchange equipment, Truro.—Western Electric Co., Ltd.
Protective apparatus.—British L.M. Ericsson Manufacturing Co., Ltd., International Electric Co., Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd., British L.M. Ericsson Manufacturing Co., Ltd., Phœnix Telephone and Electric Works, Ltd., Siemens Bros. & Co., Ltd., Western Electric Co., Ltd.
Wood arms.—British Australian Timber Co., Ltd.
Stoneware bends.—Albion Clay Co., Ltd.
Battery boxes.—Standard Woodwork Co., Ltd.
Telephonic cable.—B.I. & Helsby Cables, Ltd., Callender's Cable Co., Ltd., Connolly Bros., Ltd., Johnson & Phillips, Ltd., Siemens Bros. & Co., Ltd., Western Electric Co., Ltd.
Stoneware ducts.—Doulton & Co., Ltd.
Insulators.—Doulton & Co., Ltd.
Ironwork.—T. Butlin & Co., Ltd., Walls, Ltd., Willetts, Ltd.
Earth plates.—T. & W. Farmiloe, Ltd.
Bronze wire.—T. Bolton & Sons.

Great Yarmouth.—The T.C. has accepted the tender of Messrs. John Baker & Co., Ltd., for 40 steel tires for tramcars, at £1 14s. 6d. each.

Grimsby.—The T.C. has accepted the tender of Messrs. E. Bannister & Co. for a six months' supply of slack coal for the electricity works, at 6s. 4½d. per ton.

Hanley.—The Governors of the new Pottery and Mining School have accepted the tender of the Adnil Electric Co. for a motor-generator for the school, at £116, this being the lowest of four tenders.

London. — L.C.C. The Highways Committee has accepted the tenders of Messrs. Bullers, Ltd., for 12,000 track insulators, at £2,375; of Messrs. Gaskell & Groocott, Ltd., for 5,000 porcelains, at £3 6s. 8d. per 100; and of Messrs. Taylor, Tunnicliff and Co., for 5,000 porcelains, at £3 13s. per 100, for the tramways department.

The Committee reports the receipt of the following tenders for the supply of 150 two-way change-over switches for the tramways :—

Johnson & Phillips	(accepted)	£362
Spagnoletti, Ltd.	..	371
British Westinghouse Electric and Mftg. Co., Ltd. ..		484
Brush Electrical Mftg. Co., Ltd.		510

STEPNEY.—The Electricity Committee reports having received the following tenders for four 300-ampere circuit-breakers at the Whitechapel station :—

G.E. Co., Ltd.	(recommended)	£23 each
British Westinghouse Co., Ltd.		33 ,,
,, ,, alternative		51 ,,
I.T.E. Electric Co. (1907), Ltd.		43 ,,

HAMMERSMITH.—In connection with the supply to Bensons, Ltd., the following quotations were received for a transformer pillar and switchgear :—

Lucy & Co., Ltd.	(recommended)	£38
B.I. & H. Cables, Ltd.		58
B.E. Transformer Co., Ltd.		62

For the supply of 2,000 yards of single-way ducts in connection with the extension of electricity supply mains, the following tenders were received :—

Doulton & Co.—1s. 0½d. per yard (recommended).
Albion Clay Co., Mr. Mansfield (5-ton lots), J. Knowles, Sutton & Co., all 1s. 0⅝d.

FULHAM.—The Electricity Committee recommends the acceptance of the following annual tenders :—

Frames and covers.—W. T. Henley's Tel. Works Co.
Packings, jointings and rubber goods.—Pryke & Palmer, Witty & Wyatt, Ltd., W. H. Wilcox & Co., Ltd., H. Franklin & Co., J. G. Ingram and Co., G. MacLellan & Co., H. Edmonds & Co.
Glass globes.—City Glass Co.
Electrical goods.—G.E. Co., W. Geipel & Co.
House cut-outs and service boxes.—B.I. and Helsby Cables, Ltd., W. T. Henley's Tel. Works Co., Ltd.
Oils.—W. H. Wilcox & Co., Ltd., Alex. Duckham & Co.

BERMONDSEY.—The following tenders have been accepted by the B.C. for annual supplies to the Electric Light Department :—

Arc lamp carbons and brushes.—Engineering and Arc Lamp Co., Ltd.; Sloan Electrical Co., Ltd.; Johnson & Phillips, Ltd.; and Morgan Crucible Co., Ltd.
Conduits, &c.—Thos. Wragg & Sons, Ltd., and Young & Son.
Engine oils.—Hy. Clark & Sons, Ltd.; Silvertown Lubricants, Ltd.; and W. B. Dick & Co., Ltd.
Cable and jointing material.—C. Mackintosh & Co.; Watlington & Co.; and Dussek Bitumen Co.
Electricity meters, demand indicators, main fuses and time switches.—Electrical Apparatus Co., Ltd.; Chamberlain & Hookham, Ltd.; Reason Manufacturing Co., Ltd.; General Electric Co., Ltd.; and W. Geipel & Co.
Street frames and covers and joint-boxes.—Sykes & Sugden, Ltd.

New Zealand.—A contract for a 21-panel high-tension switchboard for the City of Wellington has been secured by Messrs. Johnson & Phillips, Ltd., through their New Zealand agents.

Northampton.—The T.C. has accepted the tender of Messrs. Sonster & Son for extensions to the tramcar-sheds, at £1,699.

Norwich.—The T.C. Electricity Committee has accepted the tender of Messrs. Bruce Peebles & Co., Ltd., for a patent Peebles-la Cour motor-converter of 250-KW. capacity, at £844, and one of 300-KW., at £986.

The Borough Education Committee has accepted the tender of Messrs. Crompton & Co., Ltd., for an electric testing set for the Electrical Engineering Classes at the Technical Institute, at £83.

Sunderland.—The T.C. has accepted the tenders of Messrs. Ferranti, Ltd., for meters and oil switches, and Messrs. Siemens Bros. for meters.

Swansea.—The T.C. has accepted the tender of Messrs. J. R. Davies & Co. for a three months' supply of coal to the electricity station, at 12s. 9d. a ton.

Swindon.—The T.C. has accepted the tender of the Building and Public Works Construction Co., at £1,313, for the construction of the foundations and condenser pit for the additional plant at the electricity works.

Tottenham.—The following tenders have been accepted by the U.D.C. for electric lighting at the Central Library :—

H. W. Brown	£176	A. Newman, Ltd.	£94
Linzell, Dickinson & Co.	120	**Keen & Co.** .. .. (accepted)	105
Partington & Co.	153	Reynolds & Co.	99
Lund Bros. & Co.	93	J. H. Wood & Co.	110
Malcolm & Allen, Ltd.	105	Weston & Sons	170
Grant & Taylor	68	Elec. Contracts Co.	185

Trowbridge.—The tender of Messrs. Edwards and Armstrong, of Bristol, has been accepted for installing the electric light at the parish church.

Whitehaven.—The T.C. has accepted the following tenders for a year :—

Vacuum Oil Co., Ltd.—Oils.
Dussek Bitumen Co.—Bitumen.
General Electric Co., Ltd.—Electric lamps.
W. T. Henley's Telegraph Works Co., Ltd.—Tapes.
Ferranti, Ltd., and Chamberlain & Hookham, Ltd.—Electricity meters.
W. Lucy & Co., Ltd.—Fuse boxes.

York.—The T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for four trailer cars for the tramways, at £1,912.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, March 20th. At 8 p.m. At 39, Victoria Street. Paper on "Aeroplanes as Engineering Structures," by Mr. W. H. Sayers.

(North-Western Section).—Friday, March 20th. At 7.45 p.m. At Municipal School of Technology. Mr. Tookey's paper on "The Running of Gas Engines and Gas Producers."

Royal Institution of Great Britain.—Friday, March 20th. At 9 p.m. Paper on "Fluid Motions," by Lord Rayleigh, F.R.S.
Saturday, March 21st. At 3 p.m. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson, F.R.S.

Institution of Mechanical Engineers.—Friday, March 20th. At 8 p.m. At Storey's Gate, S.W. Paper on "The Chemical and Mechanical Relations of Iron, Tungsten, and Carbon, and of Iron, Nickel and Carbon," by Dr. J. O. Arnold, F.R.S., and Mr. A. A. Read.

Electro-Harmonic Society.—Friday, March 20th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

Greenock Electrical Society.—Friday, March 20th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Sub-station Equipment," by Mr. D. McDougall.

Association of Mining Electrical Engineers.—Friday, March 20th. At 7.30 p.m. At Royal Technical College, Glasgow. Paper on "Rock Drills," by Mr. C. E. Hart.

Manchester Electro-Harmonic Society.—Friday, March 20th. Concert.

Association of Engineers-in-Charge.—Saturday, March 21st. Annual Dinner.

Royal Society of Arts.—Monday, March 23rd. At 8 p.m. At John Street, Adelphi. "Howard" Lecture on "Surface Combustion," by Prof. W. A. Bone, F.R.S.

Institution of Civil Engineers.—Tuesday, March 24th. At 8 p.m. At Great George Street, S.W. Papers on "Some Recent Developments in Commercial Motor-Vehicles," by Mr. T. Clarkson; and "Comparative Economics of Tramways and Railless Electric Traction," by Mr. T. G. Gribble.
Wednesday, March 25th.—Students' visit to widening and other works on the London and North-Western Railway.

Nottingham Society of Engineers.—Wednesday, March 25th. At 8 p.m. At Welbeck Hotel. Paper on "The History and Romance of Steel," by Mr. A. W. Shepherd.

Electrical Trades Benevolent Institution.—Wednesday, March 25th. At 7.30 p.m. At the Trocadero. Annual festival dinner.

Institution of Electrical Engineers.—Thursday, March 26th. At Victoria Embankment, W.C. Paper on "Current-Limiting Reactances on Large Power Systems," by Mr. K. M. Faye-Hansen and Mr. J. S. Peck.

(Birmingham Local Section).—Wednesday, March 25th. At 7.30 p.m. At the University, Edmund Street. Paper on "Static Transformers for the Simultaneous Changing of Frequency and Pressure of Alternating Currents," by Mr. A. M. Taylor.

(Manchester Local Section).—Tuesday, March 24th. At 7.30 p.m. At the University Physical Laboratory. Paper on "Experiments on Air-blast Cooling of Transformers," by Mr. F. J. Teago.

(Scottish Local Section).—Tuesday, March 24th. At 8 p.m. At 207, Bath Street, Glasgow. Discussion on "Electric Battery Vehicles," introduced by Mr. A. Page.

Society of Dyers and Colourists.—Thursday, March 26th. At 8 p.m. At the Dyers' Hall, Dowgate Hill, E.C. Paper on "Illumination in connection with the Textile Industries," by Mr. Leon Gaster.

Junior Institution of Engineers.—Friday, March 27th. At 8 p.m. At 39, Victoria Street. Paper on "Harmonograph as applied to Advertising," by Mr. A. Forbes.

(North-Western Section).—Thursday, March 26th. At 7.45 p.m. At Manchester. Paper on "Power Driving of Small Workshops," by Mr. T. R. Wollaston.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 27th. At 7.30 p.m. At Philosophical Society, Westgate Road, Newcastle-upon-Tyne. Paper on "High-Speed Bearings," by Mr. G. Stoney.

Physical Society of London.—Friday, March 27th. At 5 p.m. At Imperial College of Science. Papers on "A New Type of Thermogalvanometer," by Mr. F. W. Jordan; and "An Experiment with an Incandescent Lamp," by Mr. C. W. S. Crawley.

Royal Institution of Great Britain.—Friday, March 27th. At 9 p.m. At Albemarle Street, W. Paper on "Improvements in Long-Distance Telephony," by Prof. J. A. Fleming, F.R.S.
Saturday, March 28th. At 3 p.m. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson, F.R.S.

Faraday Society.—Friday, March 27th. At 4.30 p.m. At Burlington House. Discussion on "Optical Rotatory Power."

Finsbury Technical College Old Students' Association.—Friday, March 27th. At 8 p.m. At Waldorf Hotel, Aldwych, W.C. Eighth annual smoking concert.

Manchester Association of Engineers.—Saturday, March 28th. At Grand Hotel, Aytoun Street. Annual General Meeting. Address on "The Training of Engineers," by Mr. J. C. Maxwell Garnett.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, March 23rd.—"A" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Tuesday, March 24th.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Wednesday, March 25th.—Recruits. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m. Rating examination for all Companies, 7 to 10 p.m.
Thursday, March 26th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Friday, March 27th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Saturday, March 28th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

A Traffic Regulator for Motor-cars. — Messrs. Simms Motor Units, Ltd., of 191, Wardour Street, W., recently gave a demonstration of new devices intended to simplify traffic movements. The simplest of the two devices, *i.e.*, the arrow regulator, consists of two switches fixed to the spokes of the steering wheel of the motor-car, with a black vulcanite top clearly marked "Right" and "Left" showing, when one or the other switch is pressed, in a neatly finished oblong metal box fixed centrally at the back of the car, a white arrow in a red field. The latter, of course, corresponds with the direction in which the driver of the motor-car intends turning, thus giving ample warning to pedestrians, or the following traffic. Instead of the single regulator, two circular lamp-shaped regulators can be fitted to the hood hinges on the sides at the back of the car.

The other type of Simms patent traffic regulator does even more, for not alone does the instrument show by means of arrows the direction in which the car is going to turn, but it will also show the words "Slow" and "Stop" in white letters in a red field. The word "Slow" appears immediately the foot clutch pedal or the foot brake is applied. The word "Stop" appears in white letters in a red field on the regulator immediately the hand brake is being applied.

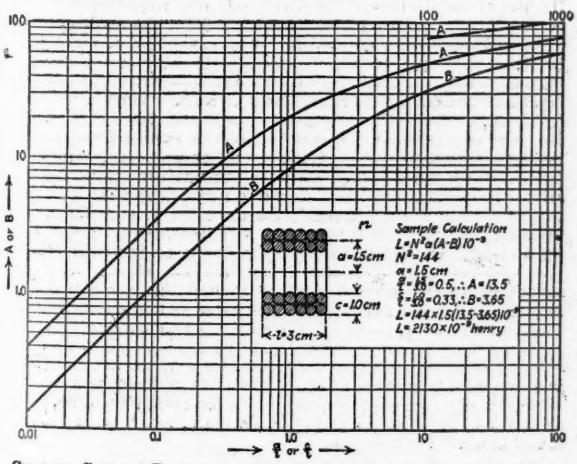
This type of regulator is fixed at the back of the car in place of the red rear light, and is also combined with the red rear light. If desired, the word "Stop" may also be made to appear when applying the foot brake. If required, two extra switches can be fitted at the bottom of the steering pillar operating the arrow regulators automatically, when the steering wheel has been turned through an arc of 20° either side, thus giving an additional automatic indication of the direction of the turning car.

These traffic regulators are fitted with two or four C.P. bulbs, which require very little current, the latter being taken from a dry battery, or from any accumulator. The electric wiring and the arrangement of the switches are extremely simple, and very neat in appearance. Everything is made dust, damp and fool-proof, and there is nothing to get out of order.

The Inductance of Air-Cored Solenoids.—In the *Electrical World* of January 31st, Mr. Leonard A. Doggett presents a universal formula for the inductance of an air-cored solenoid. At the present time air-cored solenoids find application as current-limiting reactances in central station work, and as tuning coils in wireless telegraphy.

The formula offered for the inductance of an air-cored solenoid is—

$L = N^2 a (A - B) \times 10^{-9}$ henries, where N = total number of turns; a = mean radius of coil in centimetres; A = a function of the ratio mean radius/length = a/l, and is given by curve A; B = a function of the ratio winding depth/length = c/l, and is given by curve B.



CURVES GIVING RATIOS OF MEAN RADIUS AND WINDING DEPTH TO LENGTH.

The accompanying curve sheet is self-explanatory, and contains a sample calculation.

In order to test the accuracy of the formula, comparisons were made between the calculated and measured values of the inductance for 50 coils. The average inaccuracy for these cases was about ± 2 per cent.

The foregoing formula will serve for most ordinary cases where the space factor, defined as the ratio of the copper area to the product of the length × the winding depth, is above 35 per cent. For lower values a correction factor needs to be applied which is 1·01 for a space factor of $\frac{1}{3}$, 1·04 for $\frac{1}{4}$, 1·08 for $\frac{1}{5}$, 1·12 for $\frac{1}{6}$, 1·21 for $\frac{1}{8}$, and 1·28 for $\frac{1}{10}$.

Greenwich Power Station Staff.—The *Times* announces that at the joint request of the London County Council and the workmen concerned, Sir George Askwith has appointed the following Court of arbitration to decide a claim for a reduction of hours at the Greenwich electricity generating station:—Mr. E. Moon, K.C. (chairman), Sir A. Kaye Butterworth, Mr. T. L. Devitt, Mr. W. Brace, M.P., and Mr. A. H. Gill, M.P.

A New Association.—At a meeting held in London on Wednesday last week, it was decided to form an "Association of Managers, Supervising Engineers and Permanent Foremen attached to the Electrical Contracting Trades." There was a very large attendance, and every gentleman that attended the meeting enrolled himself as a member of the Association. The preparation of rules for the general working of the Association was left in the hands of a committee, which will report to a general meeting to be held in about a month's time. It was settled, however, that foremen would have to be employed in the electrical contracting trade for a certain period before being able to become members; in the same way, supervising engineers also must have been employed in the electrical contracting trade for a certain period, during part of which they must have been actually supervisors of work.

The objects of the Association are:—

(*a*) To assist members in obtaining information of situations.

(*b*) To form a technical library for the use of members.

(*c*) To form a benevolent fund for the assistance of members in distress.

(*d*) To endeavour, by means of lectures and visits to large works, to maintain a high standard of efficiency of all members.

(*e*) To foster the apprentice system for learners in the electrical trade.

(*f*) To endeavour to extend the attendance of electrical workers at evening schools, both technical and practical.

(*g*) To arrange for the reading of papers on electrical subjects by members or visitors invited from other societies.

(*h*) To arrange periodical social gatherings to promote knowledge and good fellowship amongst members.

The entrance fee is 5s., and the subscription 2s. 6d. per quarter, payable in advance. Applications for membership should be addressed to the hon. secretary, Mr. C. J. Banister, 14, Pulborough Road, Southfields, S.W.

Electricity Supply in China.—At a recent meeting of the Engineering Society of China, it was decided to appoint a committee to consider and discuss the standardisation of system or systems of electricity supply in China, with a view to placing recommendations before the proper Government authorities, officials of foreign settlements, holders (present and prospective) of concessions for the supply of electricity, and the various engineering firms concerned. In view of the multiplicity of voltages, frequencies and systems in use in other countries, it seemed both desirable and possible to choose a single low-tension system for domestic supply and one or a relatively few systems for generation and transmission.

It may possibly be found that a single L.T. system may be too ideal in aim, but it is the object of the Committee to reduce, in any case, the alternatives to the absolute minimum, bearing in mind that the cost of mains should be kept down to the lowest value consistent with efficiency; which means that use must be made of the highest L.T. pressure consistent with safety in operation.

If the Committee succeeds in obtaining official recognition (and there is every prospect that it will) of a single L.T. system, the following advantages will be secured:—

1. Buyers of electrical plant will receive tenders on a comparable basis.

2. The possibility of interconnecting different systems and the consequent use of large bulk supplies, which is almost impossible in many of the larger European cities.

3. Minimising the variety of electrical stock, such as lamps, meters, motors, transformers, and general supplies, keptat thetrading centres.

4. The interchangeability of consumers' appliances.

The Committee hopes that the publication of this statement will lead to such discussion and support as will assist it in its work. The Secretary of the Electricity Standardisation Committee, from whom we have received the foregoing particulars, is Mr. R. A. Williams, and his address is the Municipal Electricity Works, Fearon Road, Shanghai.

Copper.—The first fortnight of March sees prices of standard again lower, and a continuation of the steadiness in visible supplies which has been a leading feature of the situation since last September. In the face of the exceptionally high consumption of last month, the maintenance of the visible supply figure is the more remarkable. For mid-March, as shown by Messrs. Merton's circular, European visible supplies stood at 26,755 tons, a decrease of only 198 tons since the end of February. English stocks, at 10 488 tons, show an increase of 89 tons over the figures for the end of last month. With regard to actual supplies for the fortnight, arrivals from North America are lowish, from Spain and Portugal to England and France a very small quantity, Chile being, however, well above average, and Australian shipments nearly up to average.

American stocks for the end of February were given as 34,987 tons, a reduction of 3,984 tons on the quantity for the end of January. The world's supply at the end of February had attained the very respectable figure of 61,940 tons, a reduction of 2,975 tons on the quantity for end of January, or considerably less than the drop in American supplies. The world's visible supplies are now higher than they were last August, though lower than the quantity for the end of December—which is, as being the last item in calculating the figures for the year, likely to include stocks which might otherwise be considered in suspension.

The E.T.B.I.—At the annual dinner of the Electrical Trades Benevolent Institution, on Wednesday next, March 25th, Mr. Wordingham and Mr. Faithfull Begg will be the vice-presidents.

The annual meeting of the Institution was held on Wednesday afternoon, Mr. A. B. Anderson in the chair. The report was adopted. We shall give an account of the proceedings next week.

Electric Interlocking of Motor Operation.—The wiring scheme shown herewith permits of the interlocking of any number of electric motors which are intended to be operated simultaneously, the arrangement being such that if one motor oil switch in the system opens, all the rest will automatically open likewise. This feature of motor control is provided by reconnecting in the manner shown the overload and no-voltage relays which are regularly furnished with oil switches. A, B and C represent the three legs of a three-phase motor circuit. Across one pair of these legs is connected a series circuit consisting of all the relay contactors, a series resistance and the no-voltage coil of the main feeder switch. The no-voltage coils on the motor oil switches are also connected in series with definite resistances as shown, while the overload relay coils are connected in the usual manner. Any

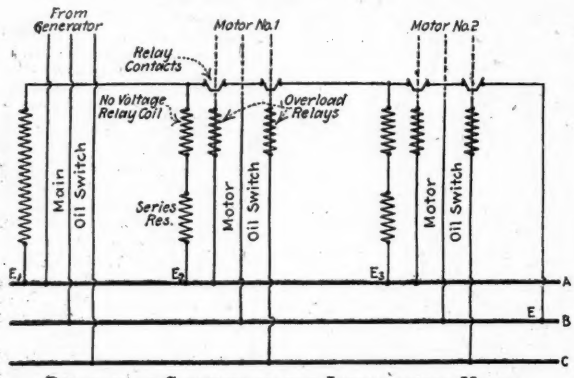


Diagram of Connections for Interlocking Motor Controllers.

relay contactor, upon opening, will thus trip the no-voltage relays of the other motors, either directly or indirectly, by first tripping the main oil switch. The scheme described is in use in the Commercial Milling Co.'s flour mill at Detroit, Mich., where the satisfactory production of flour depends on the simultaneous operation of all the machines in the system. The resistances shown in series with each no-voltage relay coil were inserted in the case mentioned, since these coils were not designed to operate on 440 volts, the difference of potential between the feeder legs. If the scheme shown is applied to a system containing several motors, it will be advisable to connect E, E_1, E_2, &c., to a separate operating bus energised by a small step-down transformer connected across one phase. If this were done, no energy would be wasted in resisters, and the contactors which are exposed on the oil-switch panels would not be carrying a fatal voltage.—*Electrical World.*

A Preliminary Examination.—A correspondent who recently replied to an advertisement in our pages was staggered by the receipt of a long letter in reply, which disclaimed any intention to get information on the cheap, but contained an enclosure posing over 40 questions, mostly of a technical nature, and necessitating an intimate acquaintance with the details of the device to which they related. The questions ranged over the whole subject from the fundamental design, through the workshop organisation to the final installation, and concluded with a number of inquiries of an intimately personal character. We have never before seen anything to compare with this extraordinary catechism, which carries with it no guarantee of engagement or even of a fee for the valuable information that would be received, not only from the successful candidate but also from the many who failed to obtain preferment.

The firm may be acting in perfectly good faith, but such eccentricities are not calculated to inspire confidence in the aspirant to advancement, and we cannot but regard them as objectionable in the extreme.

Improved Glow Lamps.— Nitrogen-filled metallic-filament lamps are now being sold on the Continent for low voltages, down to quite small candle-powers, and are in use on motor-cars in the smallest sizes. It is understood that similar lamps of small candle-power for ordinary lighting voltages will shortly be on the market in Germany. Lamps of 25 watts at 120 volts have an alleged efficiency of $\frac{3}{4}$ watt per hefner (0·74 watt per C.P.); 50-watt lamps are sold for voltages up to 260 volts. It is, however, very questionable whether the efficiency of the newer lamps is really much better than that of the ordinary metallic-filament lamps, though the strength of the filaments may be greater, the filaments of the former being shorter and thicker, and run at a higher temperature, than in the case of the latter. The greater downward concentration of the light from the nitrogen-filled lamps gives them an advantage in respect of mean hemispherical C.P., which is not realised in respect of the mean spherical C.P.

Shock by Umbrella.—It is reported from New York that the tip of an open umbrella in the hands of W. H. Heuscher touched a low hanging electric lamp while he was walking through the rain to his home in Jamaica, L.I., and Heuscher was shocked to death by the current which passed down the steel umbrella rod. The New York and Queens Electric Light and Power Co. contended that Heuscher's death was due to his own carelessness, but a jury decided otherwise and awarded $7,000 damages to his widow.

Fatalities.—An inquest was held at Tyne Dock, on Friday, touching the death of Samuel Beck, a labourer, who was killed the previous day whilst working on the timber stacks of Messrs. Pyman & Bell.—Henry Bass, labourer, deposed to ascending a stack where he found deceased lying on his left side with an electric wire under his neck and two across his body. Witness pulled him away, but he died a moment later. His right hand was grasping one wire. The wires were used for driving the sawing machines. When standing up Beck would have them 2 or 3 ft. above his head.—John Henry Morley, yard foreman, advanced the theory that deceased overbalanced himself and instinctively clutched at a wire. After the accident one of the poles supporting the wires was found to be leaning towards the timber stacks and to be cracked near the ground.—Robert Harding, in charge of the electrical plant, said that when he was called in after the accident he found the wires sagging to the extent of about 6 ft., and he thought that some weight must have been put upon them to bring them down.—In reply to Mr. W. B. Lauder, H.M. factory inspector, witness said he considered the wires safe, but agreed that there would be less risk if they were insulated or otherwise protected. The jury found that Beck had died of electric shock received while at work, but expressed no opinion as to the manner in which he had come in contact with the wires.

At Skinningrove, on Friday, an inquest was held concerning the death of Jonas Edwards (28), an electric overhead crane driver, who was killed on the previous Wednesday night while following his employment at the Skinningrove Ironworks.— Evidence adduced was to the effect that the crane upon which deceased was working was used to lift steel into trucks from the hot bank. About 5 o'clock on Wednesday there was no response to signals, and upon a workman climbing into the "crab" he saw Edwards lying over the rope drum in an unconscious condition. He had a grease pot in his hand as though he had been greasing the machinery, and his left hand, which was burnt to the bone of the fingers, was near the limit switch. The current was quickly switched off and artificial respiration tried for half an hour without effect.—James Drury, electrician, said the machinery would require greasing about once a day. Before greasing, the main switch should have been knocked off, as it was dangerous to do the greasing with the switch on. He thought deceased realised the danger, as when doing repairs witness always first directed him to knock off the current. Edwards had apparently stumbled and grasped at the switch in falling. Mr. A. F. Dunolly, H.M. factory inspector, said he could suggest nothing to prevent a similar accident. All depended upon the human element.—A verdict of "Death from accidental electrocution" was returned.

A verdict of "Accidental death" was returned at an inquest held at St. Helens (Lancs.), on the body of John Joseph Robinson, aged 30, an electrician at Messrs. Evans's foundry, Haydock. He was assisting in the unloading of a telegraph pole from a lorry when his head was crushed by the pole, death being due to laceration of the brain.

An inquest was held at Manchester on Tuesday, on James Herbert Hepworth (26), of Stretford, who died as the result of an accident on Sunday at the works of the British Westinghouse Co., Trafford Park. From the evidence, it appeared that deceased, who had been employed in the electrical section for two years, was instructed to put a piece of wood on a dead conductor. Hearing a cry, an electrician saw Hepworth holding a live conductor with his left hand, his feet resting on an iron girder 4 ft. from the ground. Mr. Nicholson, chief tester, said Hepworth's instructions were to make a terminal for a part of the test which was dead. The conductor which was dead was the same size as the one which was alive. He could not account for the accident, unless deceased was forgetful, or unless he thought the current was off. He would, of course, know that the current was continually being put on and off. Deceased had no right to be at the place where the accident happened, and there was no reason why he should be there. Medical evidence showed that death was due to paralysis of the heart, which had been greatly distended, and was due to the passage of a strong electric current through the body. A juryman suggested that some means might be used by which a workman would know that the current was on. Mr. Pollard (H.M. Inspector of Factories) said there ought to be something to distinguish the live conductor from the dead, but nobody had found out anything to do that. A verdict of "Accidental Death" was returned.

The Staff Engineers' Association.—The Association has recently published a small pamphlet which gives the objects and rules of the Society, which is being established to further the economic interests of its members, and to promote in public and commercial circles a higher sense of the rank of the engineering profession. The annual subscriptions are 20s. and 15s. respectively for members above and below 30 years of age. Copies of the booklet can be obtained on application to Mr. L. H. Fletcher, hon. secretary, Staff Engineers' Association, 31, Queen Victoria Street, London E.C.

Manchester Electro-Harmonic Society.—This Society will hold its last concert this season in the Marble Hall, Albion Hotel, Piccadilly, Manchester, to-night (Friday). The artistes will be:—Baritone, Mr. L. A. O'Brien; bass, Mr. Frank E. Dyer; entertainers, Mr. J. Foster Kershaw and Madame Helena Cecile; accompanist, Mr. W. J. Smith.

Freemasonry.—A meeting is to be held to-day at Anderton's Hotel, Fleet Street, E.C., at 5 p.m., to discuss a proposal to form a new Lodge confined to the electrical and engineering professions; those who are interested are invited to be present.

The General Electric Co., Ltd.—Annual Dinner.—On Saturday last the twenty-second annual dinner of the General Electric Co., Ltd., took place at the Trocadero; Mr. H. Hirst presided, and there were present some 600 members of the staff and guests, the latter including a large number of representatives of the Oversea Dominions, eminent engineers and contractors, and members of scientific and commercial societies.

After the loyal toasts, the Chairman proposed "Electrical Industries within the Empire." Remarking that two years had elapsed since their last meeting at dinner (last year the company gave an entertainment in the Opera House), he said that in the interval the General Electric Co. had shared in the general prosperity, and had increased all their works, their staff and the number of their employés, for whom they were erecting very large club buildings; they had also started, in conjunction with friends, a new works at Southampton, to manufacture cables, the only electrical commodity which they had not previously produced themselves, and when these works were finished they would be one of the few firms that made "everything electrical"—the only one in the British Empire. They were not yet as big as their foreign rivals, which had started as great corporations, whereas the English company had begun in a small way, but they looked forward to making up the deficit in the comparative account. They had continued the policy of establishing branches in the Dominions oversea, and had recently started a new organisation in Toronto with a large staff of trained men. They were about to concentrate their London offices in a large building in Kingsway, the erection of which, unfortunately, was delayed by the strike. Looking ahead for 20 years, Mr. Hirst emphasised the importance of the Empire to electrical engineering, and the services rendered by the latter in binding the Empire together with the telegraph cable; he believed that in time the cost of messages by cable to the Colonies would come down to 2s. 6d. or 1s., not per word, but per message, that Dr. Ferranti's ideal would be achieved, and electricity would be supplied to the whole of the kingdom from 20 or 30 large stations at ½d. per unit, and that the speeding-up of locomotion would bring Quebec within 3½ days' travel, and Sydney within a fortnight. The only obstacle was the financial one. An Imperial Parliament with representatives from all parts of the Empire would then be possible, and there should be one common law, one patent law, one coinage, and uniform weights and measures throughout the Empire.

Replying to the toast, Mr. L. S. Amery, M.P., humorously drew an analogy between the House of Commons and electrical phenomena, and advocated reform in Parliamentary methods, together with the creation of a Parliament for the Empire. He urged that trade should not be dispersed at random like a wireless message, but should be guided to this country as by a submarine cable.

Sir John McCall, Agent-General for Tasmania, also replied, and described the important progress that was being made in developing the natural water-powers with which that State was richly endowed. He then proposed the toast of "The General Electric Co.," which, he said, employed over 10,000 hands, had paid a regular annual dividend, and was the largest purely British company in the United Kingdom. Its success he attributed largely to skilful management, by which the loyal co-operation of the employés was secured; the company took a keen interest in the welfare of its employés, and had not abandoned the "Sick Fund" on the inauguration of the Insurance Act. He urged that the Government should support the company's carbon works—the only one of the kind in the country, on which we should be dependent for the supply of searchlight carbons in time of war. His own instructions were to call for tenders in the United Kingdom when contracts were to be placed, not to go on the Continent. He congratulated the company on the wise policy of starting subsidiary companies in all the Dominions, and pointed out the immense importance of the markets of the Empire to British manufacturers.

Mr. M. J. Railing responded to the toast, and dwelt upon the importance of training men for responsible positions by doing away with watertight compartments between the various departments, and by providing for the interchange of commercial and engineering talent. He advocated the linking-up of the educational institutions throughout the Empire on a co-operative basis, and concluded by proposing the toast of "Scientific Institutions."

Mr. W. Duddell, President I.E.E., responded, saying that the objects of those institutions were, first, to increase the common store of knowledge; and, secondly, to organise knowledge, to set up a standard of engineering knowledge second to none, so that this country should lead the world in engineering. Dr. Alex. Russell also responded, saying that no one had done more than the chairman for the advancement of scientific training in this country. He (the speaker) sent many students to Witton Works, and they all easily got good posts afterwards.

Mr. L. G Byng proposed "Our Guests" in a brief speech, to which the Hon. [illegible] G. Jenkins and Mr. E Manville replied. Lastly, Mr. A. J. Walters, K.C., proposed the health of the chairman, referring to the necessity that a business man should have the gift of imagination and a profound knowledge of men—qualities which Mr. Hirst possessed to a marked degree. The toast was accorded musical honours, and Mr. Hirst, briefly acknowledging the compliment, invited the guests to drink to the staff of the General Electric Co. and their colleagues in distant lands.

A programme of music was performed by the Blue Austrian Band during dinner, and a concert followed the speeches.

Inquiries.—A correspondent asks:—What is the best material for making the second layer of vulcanised rubber black?

The makers of "Clemitite" insulating material are asked for.

Institution and Lecture Notes.—Institute of Marine Engineers.—On Monday last week a paper was read by Mr. J. Veitch Wilson on "Liquid Fuel."

Heavy Railway Electrification.—In a lecture delivered before the chairman and officers of the Brighton Railway Co., last week, Mr. Philip Dawson outlined the recent progress in heavy railway electrification in America and Europe. He referred particularly to the electrified freight system of the New York, New Haven and Hartford system, which at Harlem River terminal handled 65 000 freight cars (1,250,000 tons) during November last. Nearly 600 miles of electrical track, 100 locomotives and 70 motor coaches are in use. The local official opinion was all in favour of electrical in preference to steam working, and one electric locomotive had been at work continuously for 24 hours per day for 46 consecutive days, with three shifts of men. The New York Central also had some 34 miles electrified, and used 63 locomotives, while the Pennsylvania, which owned the Long Island system, had a very extensive electrical system, and was considering the question of electrifying the 230-mile section from New York to Washington. After touching briefly on tunnel electrifications, the speaker referred to the Butte-Anaconda mineral railway electrification and others on the American Continent. In Europe the Prussian State Railways had electrified some 400 miles of main line, while in Austria nearly 250 miles of similar line were in operation. The lecturer, after referring to heavy railway electrification in Switzerland—some 160 miles of line—concluded by an appreciation of the pioneer work of the Italians, who were contemplating electrifying 1,500 miles of the State railways, and reference to the work of the Midi Railway in France, which was converting 500 miles of track.

Cambridge.—A lecture and demonstration of various processes of electric welding was given at the Engineering Laboratories, Cambridge, on the 12th inst., by Mr. Reginald J. Wallis-Jones, before a large audience of the Cambridge University Engineering Society, Prof. Bertram Hopkinson being in the chair. Some interesting experiments, lantern slides and samples of welding work were shown.

Institution of Electrical Engineers.—At the meeting of the Birmingham Local Section, on Wednesday last, a discussion was held on "Electric Battery Vehicles," the introductory notes being by Mr. F. Ayton.

Appointments Vacant.—Shift engineer (32s. 6d.), engine driver (31s.), for Gillingham (Kent) Electric Light and Power Department; assistant storekeeper for Shanghai Municipal Electricity Department (£20 month); assistant electrical engineer for Worthing Corporation (£140); plumber-jointer for Municipal electricity undertaking, Singapore ($175 per month). Particulars are given in our advertisement pages.

Radium in Canada.—It is reported that pitchblende has been discovered in a mining district of Ontario.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—We referred in our issue of February 20th to a recommendation of the Ipswich E.L. Committee that Mr. Ayton should have a bonus of £100 for the past year, and a similar amount for 1914. The Council, however, by a unanimous vote altered the recommendation of the Committee to a permanent increase of salary from £600 to £700 per annum instead of a bonus, the increase to be retrospective to April 1st, 1913.

On Wednesday the Salford Corporation Electricity Committee selected Mr. H. Richardson, of Dundee, for the appointment of city electrical engineer, at £1,000 per annum. Mr. Richardson has been at Dundee for ten years.

Mr. R. J. B. Benson has resigned his position of charge engineer at the Swansea generating station.

The Aberdeen Corporation has decided to grant an increase of £50 on the salary of Mr J. A. Bell, the city electrical engineer, whose present salary is £700 per annum.

The Glasgow Electricity Committee has recommended that three of its members, along with the electrical engineer, should represent the department at the Convention of the Incorporated Municipal Electrical Association, in Birmingham, from June 15th to 20th next.

Mr. Archibald Page, chief assistant electrical engineer at Glasgow, was on the short leet of applicants for the appointment of electrical engineer for the Burgh of Salford, but the Glasgow Electricity Committee expressed the opinion that in view of the large extension of the generating plant to be undertaken in connection with the new generating station at Dalmarnock, it was very desirable that the services of Mr. Page should in the meantime be retained by the Corporation. The Committee having considered the statements made by the convener and the engineer, as to the necessity of retaining Mr. Page's services, and as to his willingness to remain in the employment of the Corporation for a period of years, recommended the Corporation to increase his salary from £650 to a maximum of £800 per annum by annual increments of £25.

Mr. C. E. Davis, mains superintendent, at Erith, has been appointed to the position of mains superintendent to the Hammersmith Council, at £150 per annum. There were 35 applicants for the position.

The Shoreditch B.C. Law and Establishment Committee reports that the motion for an increase of the salary of MR. RUSSELL, borough electrical engineer, from £600 to £750 per annum was not carried, in consequence of an equal number of votes being given for and against.

The Stoke Newington General Purposes Committee recommends the following increases of salary to officials of the electricity department:—MR. S. HANN, electrical engineer, £270 to £280 per annum; MR. H. LARGE, first station assistant, £120 to £130; MR. E. G. MACKENZIE, second station assistant, 37s. 6d. per week to £2; MR. A. H. GAY, third station assistant, from 33s. to 35s.

Tramway Officials.—The Colne Corporation has appointed MR. T. G. RICHARDSON, assistant manager of the Bradford city tramways, to the post of tramways manager.

General.—MR. HERBERT BROADBENT, electrical engineer to the Corporation of Perth, West Australia has just left this country on his return to Australia, having completed the arrangements in connection with the conversion of his undertaking to A.C. supply, in conjunction with the Government of Western Australia.

It is reported that MR. H. L. COOPER, who designed the Mississippi dam at Keokuk, Iowa, has been asked to advise the Egyptian Government regarding the utilisation of the power of the Assouan Dam.

It is stated that the Leeds Corporation Committee, which has been considering the question of municipal labour since the strike of last year, recommends that all committees employing labour shall merge into one, and that the tramways, cleansing and highways departments shall all be controlled by MR. J. B. HAMILTON, the Corporation tramways manager, whose salary shall be advanced from £1,000 to £1,500 per annum.

On Saturday last at Glasgow SIR W. BEARDMORE Bart., was presented with an illuminated address by his employés in Parkhead Forge, Dalmuir, and Mossend. Lady Beardmore was presented with an antique silver epergne and a bouquet. It was announced that the King and Queen had arranged to visit the works at Dalmuir and Parkhead in July.

MR. GEORGE BALFOUR, prospective Unionist candidate for Govan, addressed a crowded meeting in the Cinema Picture House last Friday on the subject of Ulster's resistance to Home Rule.

MR. ALAN LEE, who was engineer-clerk-of-the-works with Messrs. Handcock & Dykes, consulting engineers, has been appointed constructional engineer on the outside staff of the British Insulated and Helsby Cables, Ltd., Prescot.

MR. W. A. DAVIS is resigning his position with Messrs. Edmundson's Electricity Corporation, Ltd., on the 21st inst., to take up a position as manager for the Adnil Electric Co., Ltd., at their new branch at 25, Victoria Street, Westminster, which will be opened on March 30th. He will also be representing Messrs. Edwards Bros., of Birmingham, fittings makers, at the same address.

The marriage took place at Darlington on March 12th of MR. JOHN LEGGOT, of Messrs. Merz & McLellan, and Miss Aline Bartlett, youngest daughter of Alderman J. W. Bartlett, J.P., of Darlington.

MR. J. ARTHUR SYKES, M.I.E.E., chief electrical engineer to Messrs. Wm. Beardmore & Co., Ltd., Parkhead Forge Steelworks and Ordnance Factories, Glasgow, has received the appointment of assistant to the general manager; and MR. J. PRENTICE, superintendent of sub-stations, Glasgow Corporation Electricity Department, has been appointed to the vacant post.

MR. J. J. CHISWELL, of the firm of Chiswell & Co., buying agents, Craven House, Kingsway, is shortly leaving London on a business tour through Canada. He would be pleased to hear from manufacturers interested in the Canadian trade.

MR. W. VINCENT WAITE has severed his connection as joint managing director with Messrs. Broom & Wade, Ltd., engineers High Wycombe, and requests that all communications be addressed to his private address, "Dunoon," West Wycombe Road, High Wycombe.

The following appointments have been made at the Borough Polytechnic Institute:—Chief assistant in Electrotechnics Department—MR. GEORGE A. TOMLINSON, B.Sc., vice H. S. SAUNDERS, appointed responsible master to a L.C.C. Junior Technical Institute; assistant in Engineering Department—MR. GEORGE W. BIRD, B.Sc., vice A. E. GLADWYN, B.Sc., appointed to West Ham Technical Institute.

Obituary.—MR. JOHN GOTT.—In our last issue we were only able to refer very briefly to the work of the late Mr. Gott, who passed away at Brighton on the 8th inst. The death of this gentleman, which followed on an attack of pleurisy and pneumonia, has been heard of with deep sorrow by telegraph engineers and electricians all over the world. Mr. Gott was one of the few remaining pioneer submarine cable engineers, and the value of his work in electrical testing and practical telegraphy is widely known, while his genial disposition endeared him to all who were associated with him. Mr. Gott was born at Kendal, Westmorland, England, in 1840, and entered the telegraph service early in life. His first employment was with the Electric and International Telegraph Co. About the year 1861 he was selected to serve at Naples, Italy, in the supervision of international traffic passing over the Italian Government landlines. In 1863 he went to Tripoli, where he was employed in the operation of the first Mediterranean cable, later going to Malta on the same work. In the year 1864 he was selected to accompany the steamship *Great Eastern* as one of the electrical staff when that vessel made her first attempt to lay a trans-Atlantic cable. In 1869 he accepted the position of superintendent and electrician at St. Pierre, Miquelon, when the cable of the first French Atlantic Cable Co. was laid. Mr. Gott was one of the first men to work the mirror galvanometer for transmitting submarine cable messages and the first to install Lord Kelvin's siphon recorder. In the year 1870 he carried out a unique experiment by which he transmitted wireless signals through a distance of about 3 miles at St. Pierre, Miquelon, using the earth as a conductor. In the same year he invented an instrument which he called a "Fault-Searcher Coil," which has proved extremely useful in the localisation of faults in subterranean lines; this fascinating invention led to devising a means for communicating between ship and shore through a picked-up cable without cutting the cable or disturbing the sheathing wires. In 1877 in a paper to the *Journal* of the Society of Telegraph Engineers, London, he described an ingenious experiment that he had carried out in telephonic transmission by means of a siphon recorder, in support of the theories of Prof. Bell's telephone invention which had only shortly before that been made public. In the year 1881 he introduced an important modification of Lord Kelvin's formula in connection with the measurement of the electrostatic capacity of condensers and cables, and the value of this method has been so well recognised by submarine cable engineers that it is now used as a standard test and is known as "Gott's capacity test." In 1884, upon his retirement from the French Cable Co.'s service, he became chief electrician of the Commercial Cable Co., which position he held until his death. In 1892 he made another important invention, which is known as the "Gott Ratio Arm." His method made it possible to avoid the necessity for temperature corrections for the resistance of Wheatstone bridge coils in tests by introducing coils of manganin for one of the ratio arms. It also made it possible to obtain measurements in modern units by means of a bridge wound to discarded standards. Mr. Gott's crowning success, however, was his recent invention, described in our other pages to-day, whereby he made possible direct communication between the Pacific coast of the United States and Canada, and Europe, without the aid of human retransmission at intermediate stations. This fitting climax to his long career is acknowledged to have been the greatest triumph in telegraphy in the present century: by its means cables and landlines can be linked up together, and the ordinary Morse method of operation used. He also latterly invented a new and improved system of quadruplex working. Being a man of retiring disposition and great modesty, there is not so much on public record of his accomplishments in submarine cable telegraphy as there should be, but he was always ready to assist those who sought his advice, and his advice was always that of a man of sound judgment, ripe experience and kindly purpose. As chief engineer of the Commercial Cable Co., it fell to his lot to examine many proposed improvements and to take part in many expeditions ashore and afloat. He was a deep student of submarine telegraph engineering problems, and had no peer in the testing and localising of faults and breaks in submarine cables. He made some valuable suggestions for extending, in electrical testing, the use of curve sheets in the application of graphic methods to the localisation of cable breaks. These suggestions were adopted and are largely used to-day. In the pursuit of his scientific researches he was restless and untiring, and at times he became so absorbed in his work that he often forgot both food and sleep. His death is a great loss to the telegraph profession, as well as to his many personal friends.

PROF. E. J. HOUSTON.—We learn with great regret of the death, which occurred at Philadelphia on March 1st, from heart disease, of Prof. Edwin J. Houston. The name of Houston has long been one of the household words among electrical students and engineers all the world over, as that of an eminent teacher, writer, expert and inventor. He was one of the inventors of the Thomson-Houston arc lighting system, was for three years president of the American Institute of Electrical Engineers, chief electrician to the World's Fair, Chicago, author of a number of text-books, and editor of an electrical dictionary. The American *Electrical Review*, just to hand, in the course of a brief obituary, states that he was Emeritus Professor of Physics at Franklin Institute, Professor of Physics at the Medico-Chirurgical College, and a member of the American Institute of Mining Engineers and the American Philosophical Society. For many years Prof. Houston occupied the chair of Natural Philosophy and Physical Geography in the Central High School of Philadelphia. He was in his 68th year.

MR. SAMUEL HARTFORD.—We deeply regret to record the death, which occurred in the General Hospital in Montreal on February 3rd, after a short illness from bronchial pneumonia, of Mr. Samuel Hartford, who was well known to many men in the cable section of the electrical trade. For many years the deceased gentleman was in the employ of Messrs. W. T. Glover & Co., Ltd., as traveller and secretary. Later he was connected with the formation of the Liverpool Electric Cable Co., Ltd., and Samuel Hartford & Co., Ltd., cable manufacturers, of Liverpool. It was after the last-named company went into liquidation that Mr. Hartford went to Canada in May last year. He leaves a widow, and three children all under five years of age, and his death was quite unexpected.

MR. GEORGE WESTINGHOUSE.—By the death of Mr. George Westinghouse we have lost one of the great world leaders of the electrical industry. On both sides of the Atlantic he was well known by reason of his large interests in electrical manufacturing, and his inventions in electrical, gas engine, air-brake, railway signalling and other departments. He was born in Schenectady 68 years ago, and he passed away suddenly in New York on March 12th. For several years, it will be remembered, he presided in London over the annual meetings of the British Westinghouse Electric and Manufacturing Co., of which he was chairman. We hope to refer to his life and career more fully in a later issue.

Mr. W. Chipper.—An inquest was held at York on March 11th into the cause of death of Mr. Walter Chipper, traffic manager of the city tramways. Mr. Chipper, who had generally enjoyed good health, awoke on the previous morning and complained of pains in his head. A doctor was sent for, but in the meanwhile Mr. Chipper died. The medical evidence attributed death to heart disease, and a verdict was given to that effect. Since the installation of the electric tramways in the city Mr. Chipper had been traffic manager, having been previously manager of the horse tramways. He was a native of Woolwich, where for some years he was manager of the tramways.

Wills.—The late Mr. Salomon Falk, managing director of Messrs. Falk, Stadelmann & Co., Ltd., left estate valued at £122,133 gross.

The late Mr. Marcus Zambra (of Negretti & Zambra) left £81,609 gross and £80,197 net personalty.

NEW COMPANIES REGISTERED.

Bishop's Castle Electric Light and Power Co., Ltd. (134,545).—This company was registered on March 13th, with a capital of £2,500 in £1 shares, to carry on at Bishop's Castle and elsewhere in the county of Shropshire, the business of an electric supply company, to take a transfer of the rights, privileges, liabilities and obligations conferred or imposed upon H. O. H. Wenman by an agreement between himself and the Corporation of Bishop's Castle. The subscribers (with one share each) are:—G. W. Summers, Penn Fields, Wolverhampton, gentleman; F. S. Turner, Woodlands, Dudley, manufacturer; F. H. Hendle, Oaks Crescent, Wolverhampton, printer; H. Donaldson, Heath Hayes, Cannock, secretary; H. O. H. Wenman, 42, Lichfield Street, Wolverhampton, consulting engineer; D. E. Campbell, 79, Lichfield Street, Wolverhampton, incorporated accountant; F. R. W. Hayward, 65 Lichfield Street, Wolverhampton, solicitor. Minimum cash subscription, 700 shares; the number of directors is not to be less than three or more than seven; the first are G. W. Summers, F. S. Turner, F. H. Hendle, H. Donaldson and H. O. H. Wenman; qualification, £25. Registered office, 79, Lichfield Street, Wolverhampton.

Frederick Hillier, Ltd. (134,553).—This company was registered on March 13th, with a capital of £500 in £1 shares, to carry on the business of electrical engineers, exhibition show-case fitters and general contractors. The subscribers are:—F. Hillier, 89, Malvern Road, Kilburn, N.W., builder, &c., 100 shares; L. Franklin, 11, Belfast Chambers, Regent Street, W., merchant, 25 shares; J. Bruce, 11, Southampton Row, W.C., accountant, 10 shares. Private company. Table "A" mainly applies. Secretary, J. Bruce. Registered office, 11, Southampton Row, Holborn, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

City of Oxford Electric Tramways, Ltd.—A memorandum of satisfaction in full on February 23rd, 1914, of debenture dated February 18th, 1910, securing £55,000, has been filed.

British and Colonial Lighting Co., Ltd.—A memorandum of satisfaction in full on February 26th, 1914, of debentures dated May 12th, 1909, June 25th, 1912, and February 14th, 1913, securing £7,000, has been filed.

Electro-Flex Steel Co., Ltd.—Issue on March 7th, 1914, of £7,000 debs., part of a series of which particulars have already been filed.

Pernambuco Tramways and Power Co., Ltd.—Issue on February 26th, 1914, of £100,000 debs., part of a series of which particulars have already been filed.

Church Stretton Electric Supply Co., Ltd.—Mortgage dated March 5th, 1914, to secure £550, charged on land with generating works thereon at Crossways, Church Stretton, and a Provisional Order. Holder: E. Bond, 43, Thorloe Square, South Kensington.

Wellingborough Electric Supply Co., Ltd.—Issue on March 3rd, 1914, of £1,000 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Jarrow and District Electric Traction Co., Ltd.

The directors' report for 1913 shows a total revenue of £7,733, an increase of £501. After deducting all expenses chargeable to revenue, including interest on debentures and loans, and making a provision of £800 for renewals, there remains a surplus of £2,458, plus £843 brought forward. There is placed to reserve £1,025, a dividend on the ordinary shares at the rate of 2½ per cent. for the year absorbs £1,249, and £1,028 is carried forward. The shipbuilding industry in the district was satisfactory during the year, and the traffic receipts consequently show a gratifying increase.

The Northern General Transport Co., Ltd., which was formed with the object (*inter alia*) of carrying on and developing in the Northern Counties transport business in all its branches, made an offer to all the Shareholders of the Gateshead and District Tramways Co., the Tynemouth and District Electric Traction Co., Ltd., and this Company respectively, to exchange their holdings for fully paid holdings in the Transport Co. on the terms contained in a letter dated 12th December, 1913, from the Transport Co.

Holders of 99 per cent. of the total issued share capital of this Company have accepted the Transport Co.'s offer to exchange shares.

The annual meeting was held on Thursday last week at the Electrical Federation Offices, Kingsway, Mr. Geo. J. Somerville presiding. In moving the adoption of the report the Chairman said the total revenue for the year had amounted to £7,733, which was an increase of £500 over that of the previous year. They had made provision amounting to £800 for renewals, which compared with £700 a year ago, and they proposed that the balance, amounting to £3,301, should be applied as follows: £1,025 to the reserve fund; £1,248 in payment of a dividend on the ordinary shares at the rate of 2½ per cent. for the year, leaving £1,028 to be carried forward. The dividend was ½ per cent. in excess of that paid last year, and the amount carried forward was £185 more. The company was in a very sound position, and it was to be hoped that the increases made last year would be continued in the future.

Mr. H. S. Day seconded the motion, and the report was adopted.

Oxford Electric Co., Ltd.

The annual meeting was held on March 6th at Oxford. Sir Henry Mance, in his financial memorandum, read by the Secretary, said that the capital expenditure under the heading engines and boilers was chiefly due to the two new Babcock boilers and steam piping, which cost about £1,500; 150 services to new consumers cost nearly £1,000; moving the substation from George Street to Red Lion Square cost £415 for mains, and the duplicate H.T. mains to Walton Street substation cost £632. Nearly 40 new consumers were on a hire-purchase arrangement. The total capital expenditure of the year was £8,400, and as there was no finality in the capital account of an electric light undertaking it would be necessary to create fresh capital to meet or partially meet the expenditure of the next few years. At present, after allowing for the writing off of obsolete plant, the capital account was overdrawn to the extent of £16,817. As regards revenue account, thanks to the Diesel engine, the increase in the fuel bill was trifling, although coal was higher, and they had generated an additional 70,000 units.

Mr. Francis, the Chief Engineer, then gave an account of the engineering work done during the year. The new substation had been designed to accommodate all reasonable extensions that might be expected in the future, and would accommodate the Broad Street battery, which would be transferred as soon as the lease of the Broad Street premises expired. Two new boilers, while occupying the same space, were nearly double the capacity of those displaced. The average price of coal per ton during 1913 was 8.9 per cent. over that of the preceding year. The cost of fuel oil had increased 55 per cent., but this did not affect the fuel figures for 1913 as they were still using oil obtained under the old contract at a much more favourable price. They endeavoured to hold a stock of coal which, with all supplies cut off, would last about one month in the winter and two and a-half months in the summer. In addition, a stock of fuel oil was carried for the Diesel engine which would enable the winter stock of coal to last about a further three weeks and extend the summer period to about four months. The final test of the Diesel engine was taken in April, 1913, the result being quite satisfactory. Since that date till the end of the year, the engine ran a total of 2,544 hours. It generated during the year 26.6 per cent. of the total units, a lower percentage than would have been the case but for the curtailing of the running of the engine on account of the high price of fuel oil. In July, the engine generated 96 per cent. of the total units for the month. In some respects, the year 1913 has been a record one, more kilowatts having been demanded than during any previous year. This had been chiefly required for motive power, 33 motors equalling 153 H.P. having been added. The total number of motors now on the system was 249, equalling 709 H.P. A satisfactory feature was the more extended use of motive power by builders for mortar mills, concrete mixing, stone-cutting and hoists. The number of heating appliances (radiators, kettles and irons) added was 59, as against 54 in 1912, bringing the total number of heating appliances up to 274. The number of new services during the year was 162, as against 146 in 1912.

The Chairman said that the most satisfactory feature in the report was the increase in the revenue from the sale of current during the year, some £700 or £800, because this improvement had taken place notwithstanding the much larger use of lamps of lower C.P. Notwithstanding the higher price of coal and fuel oil, the cost per unit generated was slightly less than it was in the previous year. Of course their Diesel engine helped a little—not so much as they had hoped when they first made up their minds to obtain this unit. When the tremendous rise in the price of oil took place he told the manager of one of the leading oil companies that if they persisted in this high price they would temporarily kill the Diesel engine industry. They might take their own case as exemplifying the truth of that. Had the oil remained at the price they at first paid, they would certainly have ordered another Diesel engine, but as it had turned out they had obtained two Babcock boilers. There was one advantage in the Diesel engine. If one or more of the steam units broke down, the Diesel engine could be started up in about two minutes. This was a very great advantage, and he believed when oil fell to a more reasonable price they would have every reason to con-

gratulate themselves on having obtained one of these engines. Another satisfactory figure in the accounts was the reserve, which now amounted to over £20,000. They were constantly asked to make extensions which were remunerative and the increased demand for current, which would go on, would make it necessary from time to time to instal additional units to increase the capacity of the plant. It was to meet that kind of expenditure that they asked them to provide sufficient capital, £25,000, to be issued gradually as occasion required. He had been asked whether they were likely to require any of this new capital this year. He was doubtful. It would be only a small amount late in the year. The question of the electrification of the Oxford trams seemed to be postponed indefinitely.

Sir Robert Buckell seconded the resolution.

An extraordinary general meeting followed at which a resolution was passed to increase the capital of the company to £175,000 by the creation of five thousand new shares of £5 each (preference shares five per cent).

Harrow Electric Light and Power Co., Ltd.

The directors report that 119 new installations, representing 275 k.w. additional demand, were connected to the mains during 1913. At the end of the year there were 1,629 consumers with aggregate requirements amounting to 1,567 k.w. The output for the year was 526,201 units. The balance to the credit of the net revenue account, after deducting debenture interest and the interim dividend on the preference shares, was £2,340. The directors recommended the final dividend on the preference shares requiring £375, a dividend on the ordinary shares at the rate of 5 per cent. per annum absorbing £1,667, carrying forward £298. The new offices and showrooms in College Road have now been completed.

The annual meeting was held on March 5th. Mr. J. N. Stuart, who presided, said that the increase in lighting, as well as the greater extension of heating and cooking by electricity, had given a rise in consumption of 64,000 units, or 14 per cent. This was the largest increase in consumption they had ever had, and the sales for the year were 526,201. The tariff based on the assessed value of premises had been taken up by about 10 per cent. of the consumers, who were thoroughly satisfied with this system of charging. Heaters had been taken up encouragingly, and although the charge was low, it helped revenue, being mostly a day load. The electrical industry was always advancing and they now had on the market a half-watt lamp of 500 c.p. and upwards. They already had a fair number of cookers out on hire, and expected many more to be put in use as the summer approached. The gross profit, £6,337, was considerably in excess of the best year that they had previously had. The cost per unit, 2.24d., was the lowest they had yet reached. With the £2,600 put to depreciation, that account now stood at £27,300. The installation account showed a small profit.

The report was adopted.

Madras Electric Tramways, Ltd.

The annual general meeting was held on March 12th, at the offices, Dashwood House, E.C. Mr. Arthur Maxwell Quill presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev. p. 460), said the accounts again showed an improvement upon the preceding year, their profit from running, after providing for all expenses in Madras, having increased from £20,010 in 1912 to £20,975, or about 5 per cent. Adding interest from investments, etc., they had a total gross profit of £21,345. As he anticipated last year, the option which they had granted on 8,500 preference shares was fully exercised, and the total number of shares of that class now allotted was 20,000. The only other item in the balance sheet to which he need refer particularly was the depreciation and renewal fund. During the year they relaid a considerable portion of their track with 90lb. rails, the total amount chargeable to the fund being £6,545. They had, however, porvided a sum of £7,000 out of profits, thus increasing the amount at the credit of the fund to £8,100. Although the latter amount might not appear large, it must be remembered that they had during the last few years relaid practically the whole of the track, and rebuilt the whole of their old type of cars. The present renewals would be completed this year, and the expenditure thereon should during the next 10 or 12 years, therefore, be greatly reduced. Their traffic receipts during 1913 amounted to Rs. 644,201, being an increase of 7.71 per cent. on 1912, and the number of passengers carried was 16,747,853, an increase of 5.36 per cent. That improvement was due entirely to natural growth, which he was pleased to say was being maintained this year, the increase in traffic receipts for the first two months being at the rate of 9.3 per cent. on 1913. The opinion expressed by him at their last general meeting that they could hardly look for any marked improvement from the existing lines was therefore over-conservative. They had, however, last year a considerable increase in operating expenses, due to the congestion in the district of Chuitadripet, where a single line only was practicable. As he told them at their last general meeting, negotiations had been proceeding for a long time, for a diversion of this line along Mount Road, but he was sorry to say that no settlement had yet been arrived at. The proposal to lay a line along Mount Road and Body Guard Road over Government House Bridge and St. Mary's Bridge was not favourably received, and they concurred, as an alternative, in a proposal made by the corporation to lay a double line through Napier Park. Government, however, had now suggested a scheme of road widening in Chiutadripet which would permit of a double line of rails through that area. It was proposed that the cost of the road widening should be borne by Government, the Madras Corporation, and themselves, and as soon as estimates of the cost were obtained, they would give the proposal their careful consideration. Meantime any extension of their undertaking was impossible, as they could not handle further traffic until the difficulty in Chiutadripet was overcome. Their costs of operation had been increased by higher rates of wages to their employees and by the provision of uniforms to drivers and conductors. Their managers in Madras had always shown a deep interest in the welfare of the men, and they were glad to encourage it, as they felt that the employés should participate in the improved position of the undertaking, and also because they recognised that the interests of the shareholders were best served by having a body of contented workpeople. An increase was also shown in rates and taxes. Close working arrangements having existed between the company and the Madras Electric Supply Corporation for some time, it was considered advisable that the management in Madras should be merged, and that arrangement took effect on December 1st last.

Mr. James Gray seconded the motion, and the report was adopted.

Salisbury Electric Light and Supply Co., Ltd.

The report of the year ended 31st December, 1913, states that the generating plant has been sufficient to meet the output and the whole of the plant is in thorough working order and capable of dealing with a considerably increased demand. The profit on the year's working, including £1,004 brought forward, amounts to £6,788, and after paying £1,189 interest on debentures and an interim dividend at the rate of 4 per cent for the half-year, amounting to £700, there remains £4,898. The directors recommend a further dividend at the rate of 8 per cent. for the half-year, making with the interim dividend, 6 per cent. for the year, £2,400 being carried to reserve, leaving £1,098 to be carried forward.

The Chairman (Mr. W. M. Hammick), in the course of some remarks, expressed the regret of the directors and shareholders at the death of Mr. A. R. Malden, who had been secretary of the company from the beginning. Mr. A. B. Randall, who had been manager, had been appointed Mr. Malden's successor, and Mr. E. C. L. Parker had been appointed legal adviser to the company. The year, the chairman said, had been an anxious one for the company, and one cause for this had been because the contract with their largest consumer, the London and South Western Railway Co., was approaching the end of the five years for which it was made. The company had renewed the contract, but at a reduced figure, caused by the company substituting for the ordinary lamps the arc burners. The Osram burner was finding great favour with all the private consumers, for it gave more light and consumed less electricity. In 1903 they supplied 397,611 units, and the number of consumers at that date was 446. They had steadily worked on, and in 1913 they sold 586,352 units, and their consumers had increased from 446 to 1,128. Since the company had started they had put £22,000 to the reserve.

Midland Electric Corporation for Power Distribution, Ltd.

The directors' report for the year ended 31st December, 1913, which we referred to briefly last week, shows a further improvement in the company's business. The comparative figures for the past two years are as follows:—

	1912	1913
Trading Revenue	£53,450	£63,903
Trading Profit	£30,943	£38,062
Consumers connected	2,330	2,920
H.P. connected	17,603	20,822

In June last an issue of £400,000 5 per cent. first mortgage stock was issued and allotted. From the proceeds, the debentures issued in 1903, amounting to £250,000, were repaid. The balance is being used for the capital requirements of the company. The capital expenditure during the year was £37,101. Owing to the continued growth of the company's business, further plant is required at the generating station, and an order for a 3,000 k.w. turbine set has been placed, with the object of the set being ready in ample time to deal with the next winter load.

The meeting was held at Liverpool on March 9th.

Hove Electric Lighting Co., Ltd.

The twenty-second annual meeting was held on March 10th, at Salisbury House, E.C., Mr. F. Tufnell presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 402), said there had been a reduction in the revenue, due no doubt to the more general use of metal filament lamps. He thought this falling off was only temporary, and that the cheapening of the light would cause a more extended use of electricity, and probably a general adoption of increased illumination. Unfortunately this was a matter which had little interest for any of them at the moment seeing that, after they had built up a sound and profitable business, the Hove Corporation had decided to acquire the undertaking, as they had a perfect right to do. The Corporation had notified their intention to complete the purchase very shortly, and he believed it was intended to pay the money on 26th instant, when it would be necessary to convene two extraordinary general meetings for the purpose of passing the resolution for the voluntary liquidation of the company. There would be some necessary formalities to be observed by the liquidator, in accordance with the requirements of the Companies' Act, after which the creditors of the company would be first paid, then the debenture-holders, and after them would come the preference shareholders, and lastly the ordinary shareholders. It was not without a sense of sadness that he addressed them at this, the last general meeting of the company. They would be called together very shortly to perform the last rites in connection with the business, a business which he thought they would all agree had been an eminently successful and satisfactory one in every way. The speaker proceeded to refer in detail to the initiation difficulties, personnel and general history of the company. He said that they were now in a position to arrive at some fairly accurate idea of the probable distribution to the ordinary shareholders. There was, of course, still some element of uncertainty as to the result of the realisation of the investments. Still, making every allowance, and providing for the costs of liquidation, bonuses, etc., there should be not less than £10 per £5 share to be returned in cash to the holders of the ordinary shares, which he thought, looking at the excellent dividends paid during all these years, must be considered a satisfactory result.

Col. Wood seconded the motion, which was adopted, after several shareholders had spoken in appreciative terms of the work of the board and the staff.

The Chairman proposed a resolution to the effect that a sum of £2,200 be paid to the staff at Hove as a bonus, in recognition of their services, the money to be apportioned in such manner as the chairman and managing director thought fit. He remarked that in addition to Mr. Smith, the resident engineer, there were five other engineers and a staff of over thirty. The bonus which the board proposed was a handsome one, but it was well deserved.

Mr. F. R. Reeves seconded the motion, which was carried.

Mr. Bernard Gibson next moved "That as compensation to the directors for loss of office there be paid to the board a sum equal to five years' fees."

Mr. F. Korner seconded the motion, and it was carried.

The Chairman said that the proposal would come up for confirmation at the extraordinary meeting which would shortly be held in connection with the winding up.

City of London Electric Lighting Co., Ltd.

The annual meeting was held on March 11th, at Salisbury House, E.C., Mr. J. B. Braithwaite presiding.

In proposing the adoption of the report (see Elec. Rev. p. 414), the Chairman said he had again to congratulate the shareholders on a fairly satisfactory year. The progress of the company was somewhat slow because its area was a very restricted one, but they were making continuous progress year by year in the number of works connected, in the gross earnings, and in the net earnings. The gross capital expenditure up to the end of 1913 was £2,560,873, while the capital actually received only amounted to £1,805,950, so that they had provided £754,923 from other sources. With regard to the demolition account, they had written off a total of £566,984. When they were running a business of that kind they could only put in the best plant available at the time it was purchased. That the directors had always done; and whenever improved plant had been introduced, which gave greater economy in generation, they had unhesitatingly scrapped the old plant although it might not have been worn out. The £566,000 written off was a payment legitimately made in building up the goodwill. As an illustration of the economy introduced by improved plant, this year the company had generated 33¼ million units, and they had burned 40,520 tons of coal, or 2,000 tons more than in 1904 when they generated only 20 million units. The various reserve funds showed an increase of £2,087 as compared with a year ago, even after using £53,890 for writing off; so that practically the total appropriation to reserves last year was £56,000. With regard to the revenue, there was an increase of £13,694 in the gross receipts as against an increase of £9,035 in 1912, and of £9,455 in 1911. A still more satisfactory feature was the fact that £10,909 had been retained as profit, which compared with only £1,815 in 1912 and £5,111 in 1911. The total working expenses for the year had increased by £3,785, of which the increased cost of coal represented £3,396. Coal had cost them £3,396 more although they had actually used 895 tons less, due to the fact that it increased in price 2s. 0¼d. per ton. The gross profit for the year had increased by £10,909, and the extra dividend would absorb £13,295. The balance would be provided by again reducing the balance carried forward from £24,333 to £20,484, which they considered the normal carry forward, and they had added to that the balance of the dividend equalization fund amounting to £7,352, raising the total carry forward to £27,836. As many of them would remember, the dividend equalization fund was created to provide against the possible loss of revenue owing to the use of the metallic filament lamps. The figures for last year showed an increase in connections of 2,552 k.w., and for the first time for many years they were able to report a slight increase in their net lighting connections, thus marking the end of the depression caused by the metal filament lamp. A new contract for public lighting had been entered into with the City Corporation, and a new system of overhead street lighting was now in course of installation. So far as the work had proceeded it had met with great appreciation and success. The Corporation had the right to purchase the company any time within six months of the 18th of August next. At the moment the City authorities had made no overtures of any kind, and as far as he knew there was no intention on their part to exercise their power. Proceeding, the Chairman said the most important event affecting their interests was the renewed effort to improve the electric supply of London. The London electric supply was at present drawn from about 29 power houses, 15 belonging to the Borough Councils and 14 to the companies, each serving its own restricted area, each with its engineers, etc., its own sets of generating plant, and its own reserves of spare plant, involving a large amount of useless capital expenditure. In addition to this, the system on which the current was supplied was very far from being uniform, and the result was that, at the present moment, a serious accident in any one of the power houses might easily result in a considerable area of London being deprived of light and power. What was the remedy? The unification of the London electric supply by the inter-connecting of the existing power houses. But this would involve a considerable capital outlay, and, in view of the powers which the London County Council possessed to purchase the whole of the companies' undertakings in 1931, no one was disposed to spend the necessary money. If the terms of purchase in 1931 were known, it might be possible to devise a scheme, but the terms were quite indefinite and opinions differed very widely as to their probable effect. In 1908 several of the London companies approached Parliament with a view to remedying this state of things, and proposed to establish a Statutory Joint Committee, which would have had power to issue capital for this purpose under the joint guarantee of the various companies concerned. Had this power been granted, long before this, the companies' power houses would probably have been linked up and things would have been in a more satisfactory position than they were to-day. Parliament, however, in its wisdom, struck out the clauses creating a joint committee and providing security for raising the new money, leaving the Bill, as he told the then President of the Board of Trade, merely a domestic linking-up scheme. The result had been as might have been expected, and nothing had been done under it except a little domestic linking-up, and the general position of London's electric supply stood to-day very much where it did in 1908. It was obvious that, with every year that passed, the difficulty of raising capital, even for the ordinary development of their business, would increase, and that, when the London County Council came to buy in 1931, they would buy a museum instead of a properly co-ordinated system of electric supply, and would, as in the recent case of the telephone purchase, acquire a series of undertakings which had been stinted for some years as regards capital expenditure, and upon which they would at once have to spend a very large sum of money in order to bring them up-to-date. It was therefore in the interests of the London County Council, as the purchasing authority, as much as in the interests of the companies, that something should be done, and, in his opinion, what was needed was the granting to the companies of an extension of their tenure and defining the terms of purchase, the companies in exchange to undertake the capital expenditure necessary for the co-ordination and linking up of the existing supply and making provision on a comprehensive scale for the future increase in the demand. It was with a view to such a comprehensive plan as he had outlined that important financial interests, comprising Messrs. J. H. Schroeder & Co., Messrs. Morgan Grenfell & Co., and Messrs. W. Greenwell & Co., were promoting the "London Electric Supply Bill, 1914," through the County of London Electric Supply Co., on behalf of themselves and such other of the London electric supply companies as might wish to join. The Bill proposed to give power to the London electric supply companies and the London County Council to enter into an agreement for postponing the date of purchase of the undertakings, for the variation of the terms and conditions upon which such undertakings might be purchased, and for making new provisions with regard to such purchase. At the present time, the London County Council had a special committee sitting to look into the question of improving the electric supply of London, so that all the means existed for the carrying on of immediate negotia-

tions. One might have supposed that the London electric supply companies would have welcomed such an opportunity, but, he was sorry to say, everyone of them, including their own company, had petitioned against the Bill. So far as their own company was concerned, he need hardly say that he was no party to the action which was being taken on their behalf, and dissociated himself from the action of some of his colleagues in the matter. In his opinion, unless something was done, and that promptly, the County Council itself would put forward a scheme of its own. The plan, as outlined by the bankers, had two sides to it—the engineering side and the financial side. On the engineering side, the bankers were being advised by Dr. Parshall, and it was proposed in the first instance to link up the existing power houses, thus at once setting free the large surplus store of generating plant which was already installed, and secondly, to erect one or more large power houses placed in localities where the greatest possible facilities existed for the cheap generation of electricity, so that they would be in a position to give a supply in bulk in all cases where it might be found economical to do so. In the case of their own power house at Bankside, that was one of the most favourably situated for economical generation, and it was probable that, should the scheme be adopted and the holding company formed, their power house would continue to be used for the generation of electricity for many years to come. Should this plan be carried out, the electric supply of London would be placed upon a secure basis and its future development provided for at the least possible cost. Such a plan could only be carried out through the formation of a holding company having a controlling interest in the shares of the existing companies and using its own securities for the fresh capital required, and this brought him to the second part of the plan, namely the financial part, which, perhaps, would be of the most immediate interest to them. It was estimated by Dr. Parshall that a total sum of 4½ millions would gradually be required and that this sum would provide for the linking up of the existing power houses, which he estimated could be completed in one year from the time the works were commenced, and the provision of one or more bulk supply stations with a combined capacity of 160,000 KW., together with the necessary transmission mains and transforming apparatus. In order to provide this capital, it was proposed that the holding company should issue a 4½ per cent. "A" Debenture Stock which would be secured on the bulk stations and, being a joint charge on the shares acquired, the interest on such "A" debenture stock to be charged to capital account during the period of construction. The existing debenture stocks of the various companies would be left undisturbed for the present. The preference shares would be capitalised at the rate of 4½ per cent. in 5 per cent. "B" Debenture Stock. The ordinary shares would be capitalised on the basis of 5 per cent. in 6 per cent. Cumulative Preference shares of the holding company. In addition, it was proposed to give the ordinary shares of all the companies a bonus of 30 per cent., and, further, they would receive an additional amount of ordinary shares which would be determined by a chartered accountant to be selected by the board of the companies whose shareholders deposited their shares under the scheme, or, failing an agreement, by a chartered accountant to be selected by the Board of Trade, who would apportion the amount of shares to be allotted to each company in accordance with their respective claims thereto, based on their reserves and the respective earnings and growth as evidenced by their accounts for the three years ending 31st December, 1913, and any special purchase clauses applicable to any one or more of the companies. Should this plan be adopted, the holder of each £10 preference share in their company would receive £13 6s. 8d. in 5 per cent. debenture stock of the holding company, and, as their preference shares ranked equally with the ordinary shares in any ultimate return of capital, it would be necessary for them to receive in addition some such amount of ordinary stock of the new holding company as might be deemed to be fair. On the basis of their dividend for 1913, each of their £10 ordinary shares would receive £20 of 6 per cent. cumulative preference in the new company, and, in addition, £3 6s. 8d. of ordinary stock, plus such additional amount of ordinary stock as might be awarded to them under the provision he had already alluded to. With regard to the remuneration that was to go to the bankers, if the scheme was carried through, at the present early stage of the negotiations no money had been suggested, but it must necessarily depend on the number of companies agreeing to the proposals, and in any agreement come to the bankers would only look for such reward as was usual and reasonable, and any such remuneration would be a matter of agreement between the contracting parties. Further, the intention of the bankers was to ask for their remuneration only in deferred shares of the holding company ranking for dividend after the existing shareholders had received at least £150,000 more in dividends than they had last year. They would see from this that the bankers were prepared to demonstrate their faith in the financial soundness of the scheme by postponing their chance of reward until after the present shareholders had received very substantial dividends from the holding companies. He could only renew his expression of regret that the London companies had received the plan in such a hostile spirit and that a majority of his colleagues on the Board should have insisted on their company petitioning against the Bill.

Mr. F. W. Reynolds seconded the motion.

Mr. Wilkinson and other shareholders expressed their regret that the Board should be divided in regard to their attitude towards the bulk supply scheme, and asked whether there was any possibility of the Chairman ultimately agreeing with his colleagues.

Mr. P. D. Tuckett said that as one member of the Board who could not see eye to eye with Mr. Braithwaite in this matter, he wished to make it perfectly clear that their objection to the bulk supply scheme was not one of principle. In principle most of the Board were just as much in favour of amalgamation as the Chairman, but as guardians of the shareholders' interests they were not prepared to accept a scheme which they knew in some particulars to be unsound without being given full opportunity to examine it.

Sir David Salomons said that as far as he was concerned he had no strong feelings in regard to the scheme one way or the other, and he had taken no side because he had not had an opportunity of carefully studying the particulars. The view he held was, that quite apart from any merits which the scheme might possess, they in that company had got a very good bit of meat and they must do everything in their power not to drop it for the shadow.

The Chairman, in reply, said he hoped it might be possible for the Board to agree on the matter of the bulk supply scheme—what he rather objected to was that his colleagues should pre-judge it before they had examined the Bill. Up to the present they had not had an opportunity of discussing the matter at the Board.

The report was adopted.

Brompton and Kensington Electricity Supply Co., Ltd.

Mr. H. R. Beeton (Chairman) presided on March 12th, at the offices, Earls Court Road, over the annual meeting.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 448), said the growth of the business whether estimated in new customers, or new lamps connected, continued to be satisfactory. The number of new customers connected though not quite so large as last year was, with that exception, the largest connected for the past ten years, and the number of 8 C.P. lamps connected was also with one exception the largest in the company's history. The sales of current, however, showed only a slight increase—about 2½ per cent. over last year; and as much of that increase was in low-priced units—the average price obtained being the lowest recorded—the gross receipts were only £56,484 as compared with £56,348, or £136 more. The expenses, owing to extensive alterations and improvements at the works which would not recur, to higher coal cost amounting to an average of 1s. 6d. per ton more, and to an accession of rates and taxes, were £1,800 in excess of the previous year, so that the net revenue as compared with 1912 was £1,678 less. He might add, however, that owing to contractors' delay they had only had the benefit of their second turbo set during the last quarter. With the use of it for this limited period they were able to supply the larger output for the year from practically the same coal tonnage, so that they might safely predict that, if there were no further rise in the price of coal, they would enjoy a reduced works cost in future. The sales of current so far this year showed a good improvement, and with a saving in works-cost and the prospect of small capital expenditure, they looked forward, barring unforeseen contingencies, to a better year in 1914. The fact that every year they must be drawing nearer to the point of saturation in lighting and the likelihood that with the progress of invention lamps would become every year more economical in the use of current, obliged them to look for future development to the growth of cooking and heating by electricity. This being so, they had for some years past realised that, in order to safeguard the future of their business in an essentially residential area such as theirs, it was incumbent upon them to cultivate this accessory load, and they believed that as pioneers in such development they might reasonably hope to reap a reward beyond that of which their statutory limitations in lighting permitted. The Accessories Company was the means they had planned to this end, and they had asked them to meet them there that day in order that they might see something of its premises. They had acted on the conviction that the best way to find out how to ority a new appliance was to use it. Great as was the superiority of a non-combustive cooking agent, its general adoption would only be effectually promoted by perfecting the design with reference to the many small conveniences and efficiencies the absence of which was revealed by constant use, and the degree of perfection which by general consent their domestic cookers had achieved was due to the fact that their engineers had had their kitchen under their constant observation. By this means they had been able to effect improvements before placing their goods on the market, and so to obviate the necessity of remedying defects afterwards. The possibilities of the business which revealed themselves to them in consequence of this unique combination of resources confirmed their confidence in the future. Of course, they were only in process of founding this branch of the business, and the considerable capital they had sunk in it was at present unproductive, but they looked forward to earning good profits in the future in this portion of their enterprise. The small loss which the restaurant had so far incidentally entailed they had met out of surplus profits, and such as it was they regarded it as by no

means an excessive price to pay for the assistance which it had afforded to their general business. In conclusion, the Chairman said: "You will have noticed from the newspapers during the last few days that the scheme promoted by certain responsible financiers for the amalgamation of the interests of the London companies has met with an emphatic rejection, and in this your directors have concurred. I will not enter into the nature of this scheme further than to say that the London companies may be roughly divided into two classes—those which provide adequate reserves before deciding what amount is available for dividend, and those which do not do so—and that as the proposed amalgamation was on the basis of dividends only, and irrespective of total profits, the companies which are prudently managed in this respect, among which ours, happily, finds itself, saw no particular inducement to enter into the combination, whatever general problematic benefits it might have promised. The Joint Committee which now represents all the London companies is taking steps to formulate a scheme for unification on co-operative lines which, if successful, will certainly be more economical, and as such will be entitled to more favourable consideration at the hands of the London County Council in any mutual adjustment of interests."

Mr. W. R. Davies seconded the motion.

Mr. Page asked if the balance-sheet of the Accessories Company was published.

The Chairman said it was on the table and was open to the shareholders.

Dr. Clowes pointed out that they had written £4,576 off the Accessories Co., which was a very small company, and it seemed rather a large sum. He would like to know if it was the intention of the Board to add to the capital of the Accessories Co. to the same extent, because if so then other investments would soon disappear.

Mr. Page asked how long the Board were going on nursing the reserves. The position of the company now, if they did no better, was that they could pay 15 per cent. on their capital at the end of their Order. He thought there should be some limit to the building up of their reserves for outside speculation.

The Auditor pointed out that had it not been for the reserves they would have had to raise more capital.

Mr. Pfungst asked if the Chairman could give any idea of how much more money they were going to put into the Accessories Co., and also how the £22,000 odd invested in that company was represented.

The Chairman said the capital expended in the Accessories Co. was represented as to £12,000 in premises which they thought ought to be a good investment on its merits, and the balance was represented by machinery necessary for the assembling of parts of their apparatus and stock in hand and works in progress, the appointments in the restaurant, and so on. He thought so far as it was possible to anticipate the course of the business of the Accessories Co., that the further expenditure of capital was likely to be quite small. He hoped they would be able to earn a good profit this year, for the actual loss on the restaurant was getting smaller by degrees. They recognised very fully that the departure they had entered on was speculative, but they entered on it after very full and deliberate consideration, and believed it to be necessary in order to safeguard the future of their undertaking. Their appliances were undoubtedly the best in the market, and they were supplying them not only in this country but abroad. They looked for a larger sale abroad than at home, especially in tropical climates, where coal was dear, and with steamship and railway companies, where space was a consideration in the kitchen.

The report was adopted.

Bournemouth and Poole Electricity Supply Co., Ltd.

The annual meeting was held on March 12th at the offices, Moorgate Court, E.C., under the chairmanship of Mr. A. H. Sanderson.

In proposing the adoption of the report (see Elec. Rev. p. 459) the Chairman said he was able to speak with greater confidence than usual as to the future prospects because the metallic filament lamp no longer had any fears for them. The total capital expenditure had reached £473,396, £3,819 of which was expended last year. The larger portion of expenditure had been devoted to mains extensions. The company's extensive area of supply was an advantageous one, because new districts were continually being opened up and new houses built, a large portion of which would be likely to require electric light. A further £9,500 had been advanced to the Richmond Co. on loan. They had taken up 2,570 £1 ordinary shares in the County of Dorset Electric Supply Co. upon which 17s. 6d. per share had been paid up. The revenue account showed an increase of £3,247 in the receipts from the sale of current and meter rentals. They had an increased return on their holding in the Richmond Co., which was a very satisfactory feature. The total gross revenue from all sources showed an increase of £3,958 over the previous year. Coal, oil, etc., showed an increase of £1,421, but they generated 700,000 more units than in the preceding year. There was a prospect of relief in respect to coal prices, as already the price was about 1s. 6d. or 1s. 9d. per ton less than when they placed their last contract, and he had every reason to believe that when they next went into the market they would be able to place their coal contract at a considerably less figure. Rates and taxes showed an increase of £220; this item now amounted to £3,925, which was equivalent to 2¼ per cent. on their ordinary share capital, and he must again protest against such a very heavy burden of excessive taxation being placed upon their undertaking. They were more heavily assessed than other electrical undertakings in similar towns, but although they had done all they could to impress upon the authorities the unfair manner in which they were assessed, so far they had not been able to get any relief. They had written off out of revenue for the past year £1,828 in respect of leaseholds and special redemption funds, £358 off suspense account, and £6,000 for depreciation, making a total of £8,187, which was equal to 5.46 per cent. on the ordinary share capital, which he thought should be considered quite satisfactory. The total sum written off out of revenue for the year in respect of reserves of one kind and another was £788 more than in the previous year, and the balance to the credit of depreciation account now stood at £38,284 as against £34,703. The dividend on the ordinary shares was at the rate of 7 per cent. for the year as compared with 6 per cent. for 1912, and 5½ per cent. for the three previous years. The total profits of the trading department had increased from £351 in 1912 to £687 last year. The total applications for supply received up to 31st December last amounted to 8,790 K.W., being an increase of 545 K.W. notwithstanding the slackness which had prevailed in the building trade of Bournemouth during the year; while the total connections amounted to 680 K.W. compared with 556 K.W. for the previous year. The total number of units sold in 1913 was 3,668,007, showing an increase of nearly 10 per cent. over the previous year. Since the 31st December they had connected to their mains 92 new consumers, taking an equivalent of 110 K.W. as compared with 76 K.W. for the same period last year. Of the 110 K.W., 39 K.W. were in respect of lighting supply and 71 K.W. in respect of power and heating. The consumers to date numbered 7,054. Very considerable additions to their machinery and plant were being installed at their principal lighting station. The directors decided on that policy, not only from the point of view of meeting the increased demand which they knew the future had in store for them, but also because of the reduction in cost which they could secure. The new plant was of the most economical and efficient character, and it was estimated that in coal costs alone it would enable them to make a saving of 25 per cent. or more, and seeing that the coal bill was the principal item in their works costs, that was a point which would be appreciated by shareholders. He hoped that the new plant would be ready for use next August. Of course, it was very difficult in a place like Bournemouth, where there were very few manufacturers, to obtain much business in the day time, but he was pleased to say that they were gradually increasing their day load by the extended use of electricity for heating and cooking purposes. As to the Richmond Co., the prospects there were very encouraging. That company had made a departure which they all felt was likely to lead to increased profits being earned—it had recently taken the enterprising course of changing over from generating its own current to taking a bulk supply from a neighbouring company on terms which, after providing for the necessary sinking fund to redeem the plant put out of use, showed considerable saving.

Dr. J. A. Hosker (the Vice-Chairman) seconded the motion and the report was adopted without discussion.

Chelsea Electricity Supply Co., Ltd.

Mr. W. R. Davies (Chairman) presided on March 12th at Winchester House, E.C., over the annual meeting. The year had been uneventful. The gross receipts had increased by over £2,000, but, unfortunately the debit side of the account was also £2,000 greater, and the amount they had to carry to net revenue account was only £90 more than a year ago. Coal was the item principally responsible for the increased expenditure, being £900 more. This was partly due to the larger number of units sold, and partly to the higher price of the fuel. They had bought current from the Central Co. to an amount of £640 as against £69 last year. The capital account showed that out of an expenditure of £12,700, £11,265 was for generating machinery. This was expenditure on the new Diesel plant. He could not say that the year's results were as satisfactory as they could have hoped, as they did not anticipate that the increase in the cost of fuel would be so great. There was no doubt that their plant at the present time was uneconomical, as their coal cost was 0.63d. per unit sold, which was a great deal too high. As he told them last year, the position of the station prevented them using the most economical form of steam plant, viz.: turbine engines, and they decided to install Diesel plant to generate the more considerable portion of the current. When he addressed them a year ago, there was reason to believe that the new plant would be running by the end of last year. Unfortunately many delays had occurred—partly due to the necessity for heavier foundations than were at first thought necessary, and partly to contractors' delays—but he was glad to say the erection of the first three units was practically completed, and although the plant was still in the hands of the contractors, they hoped to have it at work at an early

date. The increase in the 30 watt (8 c.-p.) connections during the year was 12,449, which was the largest they had had for some years, while the total of units sold was also the largest in the history of the company. Regarding the prospects for the current year, he thought they must look forward, in the absence of the unexpected, to better results than for the year under review, as by means of the Diesel plant they ought to get their works' cost down to a more reasonable figure, and they would also have the general increase of business which went on from year to year.

The London Electric Supply Bill proposals had been exhaustively and sympathetically considered at meetings of the chairmen of the whole of the Electricity Supply Companies for London. The figures on which the estimates of the promoters were based were most carefully gone into by a committee of engineers of the companies, headed by Sir Alexander Kennedy, and they came to the conclusion, after exhaustive examination, that the estimated results could not be justified. Acting on this advice the directors of all the companies had almost unanimously decided not to give their support to the scheme. That the unification of London's electricity supply was the proper solution for the economical conduct of the business was to his mind undoubted, and he thought they might still hope that the companies themselves might be able to put forward a scheme which would achieve the results aimed at by the promoters with a very much reduced capital expenditure, and be one that would meet with the approval of the London County Council, without whose good-will and assent to an extension of the term of occupation by the companies nothing could be done.

Major Woods seconded the motion.

Mr. R. C. Parton said that with regard to the proposed scheme, it seemed to him that there would be no harm in getting the London County Council to extend the term of exercising their option to purchase. If the promoters of the Bill did nothing themselves, it looked as if they would be the means of bringing the various companies together and getting them to step along.

The Chairman said the companies would be very glad to get an extension of their term on equitable terms.

Mr. R. H. Beeton (a director), said he thought the London County Council would be more likely to give extended terms to a more economical unification than that proposed by the financiers. He wanted the shareholders to understand that the board unanimously considered it would be disadvantageous to them to have accepted the scheme put forward.

The motion was carried.

Metropolitan Electric Supply Co., Ltd.

Mr. W. Harrison Cripps presided on March 10th, at Winchester House, E.C., over the annual meeting.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 415), said the capital expenditure now amounted to £2,172,336, or an increase of £68,339 on the year. The gross revenue was £217,605, an increase of £15,422 during the year. The working expenses were £111,316, or an increase of £12,230. The balance to the credit of the revenue account was £106,288, and from this the directors had set aside £22,000 for the reserve and depreciation fund, which now amounted to £319,000. On the whole they regarded the report with satisfaction. They showed an increased dividend. The increase in the gross revenue showed the vitality of the business and that it was an increasing one. It was true that a large amount of the gross increase was absorbed in expenses, but one of the chief items in the expenses was the cost of generation, and that showed itself in two ways. A great deal of their new gross revenue came from their new western areas which had only been opened up in the last two or three years. When they opened up a new area they started with a considerable capital expenditure and a considerable amount of plant which at first earned no dividend at all. As years went by the standing charges altered very little, and therefore the relative proportion between the costs and receipts was constantly getting in favour of the receipts. Then, in addition, the coal question was very important. Last year they were paying 15s. 1d. per ton for coal, but if they had paid the same price as in 1912 they would have saved £4,000, and as against the price paid in 1911 they would have saved £8,000. So far as they could see the price of coal was not likely to advance this year. Another item giving reason for hope was that on January 1st they installed a new turbine of 4,000 K.W. They were advised by their engineer that the capital expenditure on that turbine would soon bring itself back again by diminished works costs. Although the turbine had only been in operation two months the Board had every reason to be satisfied. The depreciation and the reserve fund was a very handsome one—£319,000. A part of that was invested in their business, but a considerable proportion was invested in outside securities. It had been their custom to put the investments down in the balance sheet at cost, but they thought it right that their securities should be valued by the auditors, and they would be pleased to know there was no grave depreciation in those securities. The depreciation a month ago on the cost price was only £289. Their Kingsway site, which had been on their hands so long, had been let on a 99 years' building lease on very advantageous terms. In regard to the London Electric Supply Scheme the Board had not arrived at their conclusion in a hurry, but the whole scheme had been considered in great detail, with the result that they had decided to oppose it. To understand the matter it was necessary to go into past history, and he proceeded to explain the position of the electric light companies in 1908, when they formed a committee with a view to getting an Act of Parliament for better working. They applied to Parliament for several things, one of which was that they might be allowed to combine for working, and another most important thing, that the term of the purchase clause should be altered. At the same time the London County Council promoted a Bill to make that body the purchasing authority in 1931, instead of the Borough Councils. The companies agreed to the L.C.C. proposal, but on the condition that when 1931 arrived the County Council should be bound to purchase all the companies, and this the County Council agreed to do. Before the Parliamentary Committee it was pointed out that a difficulty would arise in raising capital unless some security could be given to investors, and the Committee agreed to a clause by which it was provided that at the time of purchase the arbitration should take into account what money had been expended for a particular purpose and how much of it was still remaining for the purpose of profit. Unfortunately, when they got to the House of Commons this clause was knocked out. They did, however, get the right to combine, and also the proviso that the County Council should purchase all the companies. With regard to the so-called new scheme which had been promoted, it was proposed that there should be an immediate expenditure of £4,000,000 on the erection of a new station at the mouth of the river, and that in the course of a few years all the present generating stations should be scrapped; and it was said this would result in considerable profit. It was further proposed that the promoters should be a holding company and should take over the whole of the existing shares of the different companies. A further proposal was that the preference shares should be converted into debentures, and the ordinary shares into preference shares, and it was stated that by such an arrangement shareholders would get bigger dividends than they now obtained. The question at once arose in their minds: "Where is this money to come from to pay extra dividends on the shares, and also interest on the £4,000,000 for the new station?" A committee of engineers was appointed, and they reported that they considered the promoters were too sanguine with regard to increased revenue and diminished expenses. Therefore the Board came to the conclusion that such an interchange of shares would be very precarious and they considered the whole basis so insecure that they had decided to oppose the Bill. It had to be remembered that one of the objects of the Bill was to revoke the Act which the companies had striven for in 1908. It might be that shareholders would be approached to exchange their shares for those of the promoting company if the scheme went on, but, if so, he advised each one of them to go very carefully into the matter and not act without having all the facts before them. None of them would say that the electric light business could not be improved, but the idea of the Board as to the expenditure of capital was not to scrap all the stations and build a new one. Their idea was to develop the present stations up to their utmost economic capacity and, when that was done, then to build an auxiliary station to give additional supply. This agitation had been going on for some years, but he said deliberately, with a large knowledge, that there was nothing wrong with the electric supply of London and both in efficiency and price it beat other cities of the world. If they did go forward with an scheme for an auxiliary station as he had suggested, it would be no good unless they had the warm concurrence of the London County Council. Their interests were not antagonistic, but were identical, and when interests were identical they almost invariably worked together. In conclusion, the Chairman referred in high terms to the work of the staff.

Sir J. Pender seconded the motion.

Mr. H. L. Cripps spoke at some length on the question of the electric lighting business of London, and said he was mainly responsible for the appointment of the committee of the London County Council which had considered the future of the industry. He believed that any attempt to manage the electric light business of London as a colossal municipal enterprise was not only objectionable but impossible. He considered the existing conditions as to purchase very undesirable, and believed the whole subject had to be looked at from the political and administrative point of view, and not the engineering. He thought the Bill promoted ought to have the serious consideration of a strong Committee of Parliament.

Mr. Gardman congratulated the Board on paying an increased dividend.

Mr. W. J. Fisher asked who were the real promoters of the Bill, and how it came about that any private promoters could bring in a measure for the expropriation of the electric light companies without their consent. He could not understand why the electric lighting companies had not been able to exert pressure to bring some combination amongst themselves.

The Chairman said there seemed to be some misapprehension as to who the promoters of the Bill were, and it took them some months of careful investigation to find out, and even now he was not quite clear. He understood that Mr.

H. L. Cripps was the promoter, and he certainly knew more about it than he (the Chairman) did.

Mr. H. L. Cripps: The Bill is simply a proposition put before Parliament by someone responsible for it on petition, and that is the County of London Electric Supply Co. They are the promoters technically.

The Chairman said he had explained how the companies came together in 1908, and they were considering as to further action when there had been an attempt to jockey them. The County of London Co. had brought a Bill before Parliament which asked that the company or any other company should be able to make an arrangement with the London County Council. That was exactly the thing they were opposing. They said that it must not be one, but all. In the Bill the County of London Co. did not ask for powers to exterminate the other companies, but they asked for power to make arrangements with the County Council. When they had made an arrangement with the County Council they would ask shareholders to exchange their shares and they would manage the concern. He thought when the promoters knew their attitude they would drop their bill.

The report was then adopted.

County of London Electric Supply Co., Ltd.

The annual meeting was held on Monday at Winchester House, E.C., Mr. J. B. Braithwaite presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, p. 445), said that the year had again been a most satisfactory one. There had been no change in the capital, although in order to provide for future developments it would be necessary to make a further issue immediately. To summarise the report, the gross earnings had increased by £24,570, an increase of 10½ per cent. The working expenses, including the increased cost of coal of £8,464, had increased by £10,840, so that, apart from the enhanced cost of coal, the expenses had only increased by £2,000, with an increase of £24,570 in the gross revenue. The result was that the net earnings had increased £13,730, an increase of 10½ per cent., or very nearly the same amount as the increase of the gross earnings. The number of consumers had increased by 2,069, which was by far the largest increase of any London electric supply company. The applications had increased by 4,137 K.W. The units sold had increased by 3,230,845, and from every point of view the report was satisfactory. Their investment in the Bournemouth Co. had paid them an extra 1 per cent., while at Coatbridge, which had been a source of some anxiety to them in the past, they were now experiencing the benefit of a bulk supply. Some people seemed to think that a bulk supply was a "Will-o'-th'-wisp" which had no material value. Since they had had a bulk supply at Coatbridge they had not only been able to raise a sinking fund to replace the cost of the plant scrapped, but they had also received a steadily increasing interest on their investment. With regard to the demolition account, they had written off this year some £20,000. The result was that the plant now stood on a very modern basis in their books. Instead of building up a large reserve fund and renewing plant which was uneconomical they had preferred to scrap their uneconomical plant and use the reserve fund in putting in up-to-date and economical plant. They had written off and extinguished £95,000 from that account, and at the present time their plant stood at £334,000, and they had put £33,000 to the depreciation account this year, which was almost exactly at the rate of 10 per cent., which he thought was a very handsome allowance. The Royal Assent had been given to their Romford order last year, which gave them another 129½ square miles of district to operate in, which was not purchaseable by the L.C.C. There were very great possibilities in the district provided they could supply really cheap power. Many industries had been driven out of London because of the want of cheap electrical power, and if they could supply that want in Romford and attract industries there, it would be a benefit not only to the shareholders but to London generally. Including the area of their Romford Order, the company now held powers for 190.72 square miles, which was by far the largest area that any London company held rights over. Regarding the outlook for the present year, he could say that it was extremely satisfactory. Of course, they could not argue from what had taken place in two months as to what was going to take place throughout the year, but it would interest them to know that up to date the applications showed an increase of 90 per cent. over the same period last year; the units sold showed an increase of 8 per cent.; their estimated gross revenue showed an increase of 15 per cent., and the estimated net revenue an increase of 12 per cent., so that, apparently, the prosperity which had existed in the past few years was still continuing in the present year. With regard to the issue of new capital, they proposed to bring the amount of their ordinary shares and preference shares to an equal figure. At present they had 59,000 ordinary shares and 55,000 preference. They proposed to raise both classes to 65,000. That would enable them to allot 10,000 preference and 6,000 ordinary, which, including the premiums, would give them approximately £175,000 for future capital expenditure. They recognised that the shareholders who had been with them through their days of comparative adversity were entitled to any benefits which might accrue from the issue of the new shares, and they proposed to offer them to the old shareholders at prices which would give a substantial bonus. The capital expenditure during the past year amounted to £76,448, and of that nearly 60 per cent. was on mains which, as he had already pointed out, were not of a seriously depreciating character. Proceeding to deal with the Bill now before the House of Commons for obtaining a bulk supply of electricity, he said he regarded that effort on the part of a certain number of London companies to do something towards establishing the electric supply of London on something like a sound commercial basis, as one of the most important events that had taken place in the electrical industry last year. [The speaker went on to refer in detail to the history of events which had brought London electric supply matters to the present position. His remarks were in the main the same as those given in our report of the meeting of the City of London Co.—Eds., E.R.] They wanted to provide what London had never yet had up to the present, and that was an adequate source of bulk supply. They looked at Berlin and Paris and Chicago and found that they were solving the problem, and was London to wait until 1931 before doing anything in the matter? He believed that the L.C.C. at the present time were very much disposed to accept the scheme which had been suggested, and it was really more in the interests of the L.C.C. as the purchasing authority than it was in the interests of the companies. They might have supposed that an offer of that kind would have been welcomed by the London electric supply companies, and he was more than surprised at the treatment which the scheme had met with. They had doubtless seen in the papers the way in which it had been emphatically rejected without ever having been examined. At the conference which considered the scheme the Chairman himself made a motion that the report of their own engineers on the subject should not be considered until they had had an opportunity of confering with the promoters of the Bill, and at the very next meeting of the Committee he repudiated all he had said, and by a large majority the conference "turned the scheme down" without ever having looked at it. There were two sides to the scheme: one was the engineering side and the other was the financial. With regard to the engineering side, the promoters were being advised by Dr. Parshall, who perhaps had had as much, if not more, experience in large bulk supply station work as any engineer that he (the speaker) knew. On the financial side the promoters had been advised by two very eminent firms of accountants, Messrs. Deloitte, Plender, Griffiths & Co., and Messrs. G. A. Touche & Co., so it would be seen that they had spared no pains to make their scheme perfectly sound both technically and financially. Yet, despite that, the chairmen of the London companies, with only two or three exceptions, would not even deign to look at it. Having given details of the proposed scheme similar to those which he gave at the meeting of the City of London Co., Mr. Braithwaite proceeded to explain how the scheme would affect the shareholders of the County of London Co. The suggestion was, he said, that the debenture stocks should remain exactly where they were, and the preference shares of all companies should be funded on a basis of 4½ per cent. into a 5 per cent. debenture stock, behind which would be placed a sinking fund sufficient to redeem it before the expiry of the extended tenure that would presumably be granted by the L.C.C. With regard to the ordinary shares, the proposal was to fund them on the basis of 5 per cent. into 6 per cent. cumulative preference stock, and then, in addition, to give all round as a first instalment a bonus of 30 per cent. in ordinary stock of the new holding company. It was also proposed to give to the ordinary shareholders of all the companies such an additional amount of ordinary shares as was to be determined by a chartered accountant, based on their reserve funds and their respective earnings and growth. Should the scheme be adopted, the effect on their own shares would be that the holders of every 10 preference shares—that was £100—would receive £133 6s. 8d in 5 per cent. debenture stock, and the holder of every 10 ordinary shares would receive £140 of 6 per cent. accumulative preference stock, and the 30 per cent. bonus in ordinary stock to which he had referred, and in addition such an amount as might be awarded for the reserve. As to why the County of London Co. was promoting the Bill, he said it was necessary it should be put forward in the name of one of the existing companies because they were the only people who had a *locus standi* for making agreements with the L.C.C. They readily lent their name on two conditions—first that they should not pay any of the costs of promoting the Bill, and secondly, that before they lent their name they took counsel's opinion on the point that the Bill as drafted would not be in any way inimical to the interests of any of the London electric supply companies. The Bill was put forward quite as much in the interests of the other London companies as in the interests of the County of London Co.; in fact, the other companies had more to gain from the Bill, as the County of London Co. was a strong and a prosperous company with a big future, and could afford to stand alone, which did not apply to all the companies. He could only say that he was sorry that the companies had treated the Bill in such a hostile manner and had "turned it down" so emphatically as one of the chairmen said the other day. The Bill was not dead, and his own opinion was that the companies would have to come to something of the kind if the present Bill was rejected, and possibly they would

have, to come to something which would not be so favourable to them as the present proposal.

Mr. R. Percy Sellon, in seconding the motion, said he wished the shareholders to understand that the Board were unanimous in endorsing the things which the Chairman had put before the meeting. They were all of opinion that it was only by some such scheme based on broad lines that a solution of the present problem of the London electric supply could be found.

Mr. H. L. Cripps and Mr. W. J. Fisher having spoken in support of the scheme,

The Chairman, in reply to questions, said the promoters had not overlooked the question of vested interests, and their suggestion was that Water Board terms should be given to directors and officials who would be required to retire should the scheme mature.

The report was then adopted, and subsequently a resolution was agreed to approving of the scheme on the part of the shareholders.

South London Electric Supply Corporation, Ltd.

The annual meeting was held on Monday at the Cannon Street Hotel, E.C., Mr. J. Atherton preseding.

In proposing the adoption of the report (see Electrical Review, p. 457) the Chairman said that the number of lamps added during the year had been the equivalent of 28,818 35-watt lamps, and exceeded those connected during 1912, which was the largest increase they had had since the year 1908. The total connections at the end of the year amounted to 302,124 (since increased to over 311,000), and although this increase was very satisfactory, it was largely due to the connection of additional motors to the circuits, the increase in H.P. having been 820, making the total connected 5,384, but instead of the units for motive power being about equal to the units for lighting, as was the case in 1912, the units sold during 1913 for power were nearly 900,000 greater than those for lighting purposes, with the consequence that although the receipts per unit for lighting and power purposes respectively had been maintained, the average per unit sold for all purposes had declined owing to the predominance of the supply for power over that for lighting. The revenue obtained for lighting purposes was a little in excess of that for the previous year. For the purpose of increasing and popularising the use of electric light and the many useful and economical domestic electric appliances now on the market, they had carried into effect their decision to open central showrooms in one of the main thoroughfares in their area of supply, and they would be opened in a week or two. Notwithstanding the additional cost, they felt sure that by a judicious display of lighting and other accessories in the ample window space provided, and also within the showroom itself, together with the assiduous attention of their representatives, there must be a beneficial effect shortly felt in the sale of energy for lighting and other domestic purposes, there still being a large undeveloped field upon which to concentrate their efforts. The units sold had increased by nearly three-quarters of a million, from 5,118,000 to 5,741,226, or 14.8 per cent., and the gross receipts increased by £3,256; but as nearly all these additional units were sold at power rates, and they had to pay and were still paying abnormal prices for coal, coupled with the increased cost of labour, and, in fact, for all commodities, the amount retained out of the increased revenue as gross profit had been reduced accordingly. Taking, however, all the items of expenditure in the revenue account, the total was £23,475, which worked out at the very satisfactory figure of .98d. per unit sold as compared with 1d. in the previous year, this result again being one of the best obtained by any of the companies supplying electricity in the Metropolis. The capital expenditure amounted to £7,888, the greater portion of which was for extensions to mains, additional transformers, and for the connecting up of new consumers. This year they would have to meet the cost of the new showrooms at Brixton, also additional mechanical stokers and coal-handling plant at the generating station, and further extensions to the mains and the connecting up of new consumers. In regard to the change of generation from the single to the two-phase system, this had continued to operate very satisfactorily throughout the year, and had been the means of bringing several important consumers on to the mains, and further consumers had been booked for two-phase supply; these would be connected up as soon as they had completed the electrification of their works. Proceeding to deal with the Bill of the County of London Company, the Chairman said the representative committee of the various other London companies arrived at the conclusion that the scheme put forward did not commend itself as one desirable for adoption. At the same time, it was recognised by the committee that the principle of co-operation was a sound one, though they felt themselves unable to support the scheme put forward. With the view of giving effect to this, the Engineers' Committee had been requested to prepare a comprehensive scheme to provide for the electrical requirements of London, based on the joint working of the companies' undertakings and on a satisfactory arrangement being come to with the London County Council in regard to purchase. Whether anything would come of this or not they were unable at this moment to express any opinion. Meanwhile their company was in a position to satisfy all the requirements for electric energy within its statutory area at a reasonable price, and they had no reason to feel apprehensive or anxious as to the future prosperity of their business. They might rely upon the Board to safeguard their interests in this matter, but should any scheme be presented to them which they considered satisfactory in the interests of the company generally, they would then, of course, call the shareholders together so that they might express their opinion on the proposals. The returns of the new consumers booked, of work in the sales department, and of the output since the commencement of this year showed a gratifying increase over the figures for the corresponding period of last year, and although, as he said before, they were still paying an exceedingly high price for coal, they hoped that the results for the present year would show a considerable improvement upon those of last year.

Mr. Bush seconded the motion, and after a short discussion of a complimentary nature the report was adopted.

The Chairman then moved a resolution giving the Board power to issue 10,000 preference shares of £5 each. He explained that the Board only intended to issue 6,000 of the shares, as they anticipated that this amount with the reserve would be sufficient to enable them to meet all their requirements during the next three or four years. Should, however, the business increase very rapidly they might have to issue the remaining 4,000 shares.

The resolution was carried.

Windermere and District Electric Supply Co., Ltd.

The directors' report for the year ended 31st December, 1913, states that the Diesel oil plant has not yet been installed owing to delay on the part of the contractors, but it is hoped it will be at work in the course of the next two or three months. Owing to this delay the unissued debenture stock has not yet been offered for subscription, but it is proposed to make the offer of the stock shortly.

The Directors, after full consideration, decided to extend the service to Grasmere, and the necessary cable has been laid, and there is every reason to believe that the Company will receive enough revenue from the new connections in Rydal and Grasmere to give a fair remuneration on the capital cost of the cable.

The profits during the year have been adversely affected by the remarkably dry summer, which resulted in a large additional expenditure on coal, the extra cost being £363. The sales of current show an increase of £62, and the increase in the Gross Revenue is £88. 45 new consumers have been obtained, making with the additions to existing installations an equivalent of about 1700 30 Watt Lamps. A payment of 5 per cent. on account of arrears of interest has been received on the Keswick Electric Co.'s Debentures, and from this source the old balance of interest accrued from the Keswick Co. of £377 has been extinguished, and the Net Revenue Account has been credited with £94. In future the Revenue Account will be credited with the whole of the profits received from the Keswick Company.

The amount spent on capital account for new mains, transformers and meters has been £446. The expenditure on revenue account for the year has been £2,199, an increase of £316. The balance of revenue account for the year is £1,719 plus interest on Keswick debentures £94, and brought forward £40, making £1,853. Out of this has been paid debenture interest, bankers' charges, &c. £841, interim dividend of 1 per cent. on preference shares £250, cost of extending period for repayment of debenture stock £21, written off free wiring installations £88, transferred to depreciation reserve account £400, leaving for disposal £253. The directors recommend that a further dividend of 1 per cent. be paid on the preference shares which will absorb £250, and make 2 per cent. for the year, leaving £3 6s. 9d. to be carried forward.

Folkestone Electric Supply Co., Ltd.

The directors' report to Dec. 31st last shows continued satisfactory progress. The equivalent of 139,100 eight c.p. lamps was being supplied, an increase of 7,847 eight c.p. lamps. The accounts showed that including the receipts from hired installations, the profit on the revenue accounts for the three undertakings amounted to £17,611, plus £354 brought forward, and interest and installation profits, and after allowing for interest on debenture stock and dividend on preference shares, there was a balance of £11,348. Out of this an interim dividend at the rate of 6 per cent. per annum had been paid on the ordinary shares, and the directors had carried £4,810 to the depreciation fund, making it £32,753 net, and £2,500 to the reserve fund, increasing it to £6,600. They recommended a dividend at the rate of 8 per cent. per annum on the ordinary shares for the half-year (making 7 per cent. for the year), requiring £2,000, and leaving a balance of £538 to be carried forward.

Units generated	2,244,907
Units sold—Public lamps	78,506
By contract	474,596
Private consumers by meter	1,184,448
Total sold	1,737,550
Units used on works	30,874
Total accounted for	1,768,424
Not accounted for	476,483
Public lamps	Arcs 88 Incandescent 493 (M.P.)
Maximum supply demanded	1,319 KW.

Liverpool District Lighting Co., Ltd.—The directors, after transferring £900 to reserve fund, recommend a dividend at the rate of 4 per cent. per annum for the last half of 1913.

British Insulated and Helsby Cables, Ltd.

The directors' report for the year ended December 31st, 1913, states that the profit amounts to £247,351 plus £74,231 brought forward, making £321,582. The following are deducted:—Directors' and debenture trustees' fees, and remuneration to Works Committee, £5,315; interest on first debenture stock, £22,500; interest on second debenture stock, £10,000; depreciation on buildings, plant, machinery, &c., £22,000; transfer to reserve account, £20,000; transfer to special reserve account, £8,500; transfer to first mortgage debenture stock redemption account, £5,000; written off patents and goodwill, £35,000; dividend on preference shares to December, 1913, £30,000; interim dividend on ordinary shares to June, 1913, £20,000 = £178,315, leaving available for dividend £143,267. The directors recommend a further dividend of 9s. per share on the ordinary shares, making with the interim dividend already paid a total of 13 per cent. for the year requiring £45,000, carrying forward £98,267. It is gratifying to report an increase in the volume of trade compared with last year, resulting in an additional profit of £28,956. £35,000 has been written off patents and goodwill: this item, which originally stood at £251,672, is now eliminated as an asset from the balance-sheet. In addition, a sum of £8,500 has been transferred to special reserve account, a further £5,000 to first mortgage debenture stock redemption account, £20,000 to reserve account, and £22,000 applied to depreciation on buildings, plant and machinery. After deducting the afore-mentioned sums, the balance to be carried forward is £98,267.

The meeting is to be held at Liverpool on March 23rd.

Davis & Timmins, Ltd.

Sir Henry Mance, presiding at the annual meeting, held on March 12th, at King's Cross, said that the report gave them unqualified satisfaction; it was a credit to the staff, and justified the board's policy of bygone years. Everything was going on well with the works at Wood Green. There had been considerable additions to plant, additions absolutely necessary to enable them to cope with the increased volume of business. They were beginning to feel a little cramped for space. The change in the arrangement for the supply of power would help in this respect, as they would be able to make use of a well-built and commodious engine house, and so postpone the necessity for building operations for another year.

Mr. G. E. Davis, the managing director, said that, from a business point of view, 1913 was an exceptional year, and they had handled a large volume of work, though they had been hard pushed at times to satisfy all demands. By installing an entirely new and unlimited supply of power from an outside source they would be helped in that respect henceforth. Now that motive power was assured they were enabled to put down additional machines as necessary. They had no cause to complain of 1914 as far as it had gone.

Sunderland District Electric Tramways, Ltd.—On Tuesday, March 17th, Mr. Justice Eve had before him in the Chancery Division the petition of this company for sanction of a resolution reducing the capital of the company from £170,485 to £51,500. Mr. Wright, for the company, said they had carried on business without success since their formation in 1903. His Lordship: They seem to have got through £120,000 very quickly. —Counsel: Yes, in 10 years. His Lordship sanctioned the reduction and ordered the words "and reduced" to be used for a month.

The Belgian Congo.—La Société Belge de Cables Télégraphiques is the name of a new company which has just been registered in Antwerp under British auspices, with a capital of £160,000. The object of the new concern is to secure from the Belgian Government a concession for the laying and working during a period of 50 years of a telegraph cable between the Belgian Congo and the English coast. The capital is divided into 4,000 shares of £40 each, of which the Eastern Telegraph Co. has subscribed 3,000, the Telegraph Construction and Maintenance Co. 100, Sir J. D. Pender, K.C.M.G., 200, Mr. F. R. Lucas 200, and Mr. W. Hibberdine 100, all of London, M. P. Cramer, of Overeen-lez-Haarlem, 200, and M. X. Moeus, of Antwerp, 200.

London United Tramways, Ltd.—In their annual report the directors recommend a dividend of 1 per cent. on the preference shares for the year 1913. £20,000 is put to reserve for reconstruction and renewals, and £2,101 is carried forward.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended January 30th, 1914, amounted to 1,242,997, compared with 1,021,662 units in the corresponding five weeks of 1913.

Prospectuses.—*South Metropolitan Electric Light and Power Co., Ltd.*—The directors have issued a circular to the shareholders and debenture stockholders, offering 25,000 6 per cent. cumulative second preference shares of £1 each at par, less an allotment commission of 1s. per share.

London and Suburban Traction Co., Ltd.—The list was to close yesterday, Thursday, in an offer for sale of £350,000 5 per cent. "A" debenture stock at the price of 92 per cent. The issue has been made for the purpose of repaying temporary loans.

Toronto Power Co., Ltd.—This week there has been offered for sale £523,655 4½ per cent. consolidated guaranteed debenture stock of the Toronto Power Co., Ltd., guaranteed by the Toronto Railway Co. The sale price was 96, and the list was to close on Wednesday. The prospectus mentioned that 100,000 E.H.P. of plant had already been installed at Niagara Falls, and three additional units now installing will bring the total up to 11 units, 10 of which have an aggregate capacity of 125,000 E.H.P. The eleventh unit has a capacity of 15,000 E.H.P., and will be held in reserve in case of accidents. The above issue has been made to provide the cost of these works and to meet general power and light extensions.

Automatic Telephone Manufacturing Co., Ltd.—The directors' report for the year ended December 31st, 1913, states that the profit for the year was £24,166, plus £370 brought forward, making £24,537. The following are deducted:—Directors' fees, £1,225; depreciation on patents, goodwill, buildings, plant and machinery, £4,000; written off underwriting commission on shares, £3,000; written off preliminary expenses, £1,093; dividend on preference shares, £12,000; leaving to be carried forward £3,219. The business in ordinary telephone and telegraph equipment continues satisfactory, but although good orders for automatic equipment were received, it was not found possible to complete during the year any substantial amount of this class of work.

Topsham Electricity Supply Co., Ltd.—The annual meeting was held on Saturday. The chairman (Mr. A. A. Amos), in moving the adoption of the report, congratulated the shareholders upon a very successful year. The business of the company had materially increased, and the output of current had been the largest on record. The trading account showed an income of over £500 per annum, and the net profit amounted to £219. The directors proposed to divide £72 in dividends, the balance, £147, being carried to depreciation account. A dividend of 5 per cent. on all shares was approved.

Vickers, Ltd.—The directors have decided to place £300,000 to general reserve and to recommend a final dividend of 1s. 6d. per share (free of income-tax) on the ordinary shares, making 2s. 6d. per share, or 12½ per cent. for the year. The amount carried forward is £222,811. Owing to the continued rapid and profitable expansion of the business, the directors will propose to the shareholders an increase in the ordinary share capital of £1,110,000, or of one share in four of the present capital. These shares will be offered to the shareholders at 28s. per share.

Stock Exchange Notices.—The Committee has ordered the following to be quoted in the Official List:—

Hong Kong Tramways Co., Ltd.—325,000 shares of £8., fully paid, Nos. 1 to 325,000.

Singapore Electric Tramways, Ltd.—400,000 shares of 5s., fully paid, Nos. 1 to 400,000.

Montana Power Co.—A quarterly dividend of ½ per cent. on the common shares is announced.

Metropolitan Electric Tramways, Ltd.—The revenue for 1913 was £539,246. After charging all expenses, the available balance is £52,282, out of which £12,000 is put to reserve, £25,000 is required for preference dividend, 3 per cent. is to be paid on the ordinary shares, and £1,052 carried forward.

North Metropolitan Electric Power Supply Co.—A dividend of 6 per cent. per annum and a bonus of 12s. per fully-paid ordinary share are to be paid for 1913.

Braunton Electric Light and Power Co., Ltd.—The directors report a very satisfactory year's working. The net revenue account showed a balance of £136, out of which a dividend of 5 per cent. is to be paid on the cumulative preference shares, amounting to £23; £30 is to be written off formation expenses, and £50 for depreciation, £32 being carried forward. The receipts from private lighting were £199; power and heating supplies £13; contract lighting £73; contract pumping £50; rental of meters and services £20. Generation of electricity cost £176; rent, rates and taxes £21; management expenses £20; and special charges £25. The report was passed at the annual meeting.

STOCKS AND SHARES.

Tuesday Evening.

There remains still much perplexity and confusion in the money markets, which are reflected in prices and in the irregularity of the movements that occur from day to day in the barometer stocks. Everyone is expecting money to get patently cheaper at the beginning of April; building hopes, too, upon this anticipation, though, at the same time, political factors are working in the other direction, which have the effect of depressing the prices of Consols and foreign Government bonds. Affairs in Brazil and in Mexico are chaotic enough to restrain business in the stocks and shares of either country. At home, one of the most interesting events of the present week was the meeting of the County of London Electric Supply Company, held last Monday.

Notwithstanding the badness of the times, new issues continue to appear. In the Electrical section, the London and Suburban Traction Company has this week offered £350,000 of 5 per cent. "A" Debenture stock at 92 per cent., at which the return is nearly 5½ per cent. on the money, while the security is good of its class.

The Toronto Power Company, Ltd., has been making an issue of half-a-million pounds 4 per cent. Consolidated Guaranteed Debenture stock, guaranteed unconditionally by the Toronto Railway Company, and statistics were given in the prospectus of five years' working, each year showing a steady and substantial progress. The stock is well covered. London and Suburban Ordinary shares went $\frac{1}{16}$ lower, but the existing Toronto issues did not change.

Home Railway stocks move in manner most disappointing to their supporters. Week after week falls have to be recorded. This time Metropolitans are 1¾ lower, Districts losing a like amount. The falls in City and South London Junior Preference stocks have not been recovered. It is difficult to sell the 1903 issue, to pay the full dividend in respect of 1913 on which the sum of £7,400 had to be debited to capital account, while the carry-forward of the railway was but £700.

Metropolitan Electric Tramways Debenture stocks of both classes are again noticeably lower, and the market is a dull one. Underground Electric Railway shares fell ¼ to 3½, the Income bonds also receding. No further changes have occurred in British Electric Tractions, but we notice that our suggestion last week as to the advisability of consolidating the various classes of the company's stocks into some less unwieldy proportions has aroused a good deal of interest. Yorkshire West Riding Preference again rose ⅛, which took the price to 4¼, and the Debenture stock gained 2 points.

The County of London Electric meeting produced a speech from the chairman which is worth studying as a comprehensive statement of what has come to be known as the "super-company" scheme. The shareholders unanimously passed a resolution giving their adhesion to the proposals. It was declared by one of the speakers that the interests of engineers and directors might conceivably, in certain circumstances, conflict with those of shareholders, and the formation of a Shareholders' Committee was proposed that should embrace representatives from all the various electric lighting companies.

Mr. H. B. Renwick, the managing director of the County of London Electric Supply Company, may fairly be congratulated upon having produced a scheme which appears to be workable and practical. The magnitude of the task which he took up can best be measured by remembrance of the failure which has attended every effort made up to the present to bring into line the different London electric supply undertakers; and it is only by the exercise of indefatigable toil and a great deal of tact, that Mr. Renwick has succeeded in forcing the matter to its present stage.

Prices in this department are not much changed on balance, allowing for the various dividend deductions. These latter have the effect of making yields look very attractive. County of London were quoted *ex* rights on Wednesday last week. Westminster Preference are a shade easier, South Metropolitan Preference $\frac{1}{16}$ higher. This company, as well as the South London, is about to raise fresh capital.

Details have been in private circulation of a new electric supply company to deal with the Hendon district, and a public issue of Preference shares or stock may be expected before long.

Amongst Mexicans and Brazilians there are this week no sensational movements. Mexican Light and Power shares of both classes are a point down. Mexico Trams have similarly suffered. Para Electric Railways are about the same as they were, having regard to the fact that the shares are quoted *ex* dividend. What the investor should notice, however, is the flatness of Rio de Janeiro first bonds and of San Paulo First Debenture stock, both of which have dropped below par. The margin of security in each case is ample, and the yields produce an average of 5½ per cent. Rio 5 per cent. Mortgage bonds fell to 88, but these, of course, rank below the Firsts. Brazilian Tractions dropped 3½ to 83½, this raising the yield on the shares to 7 per cent. on the money. However, with the incessant shrinkage in the prices of Brazilian Government, municipal and similar securities, it is obvious that uneasiness must be aroused with regard to all the industrials connected with the Republic.

Shawinigan Water is 4 down on the decision to issue $1,375,000 new Common stock, to be offered at 120 to existing holders in the proportion of one new for eight old shares.

The Telegraph market is quiet. Westerns are ¼ higher, and Anglo-American Deferred at 24 shows an equal advance. Except for these, the movements are insignificant. Reuters remain at 8¾. Marconis are weak, the Preference and Ordinary shares both losing the gains of last week, and the market being dull once more on the assumption that the new House of Lords inquiry will simply mean that nobody will want to take an interest in the shares, from the Stock Exchange point of view, until it is over.

In the Manufacturing division, small rises occurred in British Aluminium Preference, British Westinghouse Debenture and Dick, Kerr Ordinary shares. The death of Mr. George Westinghouse would some years ago have had a marked effect upon Stock Exchange prices, but of late his name has ceased to be a power in the financial world, and the Preference shares of the British Company retain all their recent advance at 30s. Aron Ordinary are $\frac{3}{16}$ lower, and Castner-Kellners continue to droop. Rubber shares have been affected by general market conditions, otherwise the rise in the price of the raw material to nearly half-a-crown per lb. would probably have had a stimulating effect upon Stock Exchange quotations. As things are, however, the public no more interest themselves in rubber than they do in most other stocks and shares at the present time.

The National Telephone holders are to receive a further distribution of 1¼ per cent. or thereabouts, raising their full return to about 105¼. Allowing for interest on the money, the price paid to the proprietors works out to very little above 100, and the people who gave 180 for their stock are best left alone just now.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, March 18th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a „ Nitric .. .. „	23/-	..
a „ Oxalic .. .. .. per lb.	2¾d.	..
a „ Sulphuric .. .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. .. „	42/-	..
a Ammonia, Muriate (large crystal) per ton	£30 10	..
a Bleaching powder .. .. .. „	£6 5	..
a Bisulphide of Carbon .. .. „	£18	..
a Borax .. .. „	£17 10	..
a Copper Sulphate .. .. .. „	£22 10	..
a Lead, Nitrate .. .. .. „	£30 10	..
a „ White Sugar .. .. .. „	£28	..
a „ Peroxide .. .. .. „	£32	..
c Methylated Spirit .. .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	8½d.	..
a Potash, Caustic (88/90 %) .. per ton	£22 10	..
a „ Chlorate .. .. .. per l „	8¾d.	..
a „ Perchlorate .. .. „	8½d.	..
a Potassium, Cyanide (98/100 %) .. „ (for mining purposes only)	7½d.	..
a Shellac .. .. per cwt.	75/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. „	£8 10	..
a „ Recovered .. .. „	£5 10	..
a „ Lump .. .. .. „	£5	..
a Soda, Caustic (white 70/72 %) .. „	£10	..
a „ Chlorate .. .. .. per lb.	3¾d.	..
a „ Crystals .. .. .. per ton	£2 5	..
a Sodium Bichromate, casks .. per lb.	8d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£86	..
b „ Wire, in ton lots (1 to 14 S.W.G.) „	£112	..
b „ Sheet, in ton lots .. „	£112	..
p Babbitt's metal ingots .. .. „	£50 to £221	..
c Brass (rolled metal 2° to 12° basis) per lb.	7½d.	..
c „ Tube (brazed) .. .. „	9½d.	..
c „ „ (solid drawn) .. „	7½d.	½d. dec.
c „ Wire, basis .. .. „	7¾d.	..
c Copper Tubes (brazed) .. .. „	9½d.	½d. dec.
c „ „ (solid drawn) .. „	9½d.	½d. dec.
g „ Bars (best selected) .. per ton	£79	£2 dec.
g „ Sheet .. .. .. „	£79	£2 dec.
g „ Rod .. .. „	£79	£2 dec.
d „ (Electrolytic) Bars .. „	£66	£1 10 dec.
d „ „ Sheets .. „	£84	£1 10 dec.
d „ „ Rods .. .. „	£71 10	£1 10 dec.
d „ „ H.C. Wire per lb.	8¾d.	..
f Ebonite Rod .. .. .. „	4/6	..
f „ Sheet .. .. .. „	4/-	..
n German Silver Wire .. .. „	1/10	..
h Gutta-percha, fine .. .. „	7/-	..
h India-rubber, Para fine .. .. „	3/0½	8½d. inc.
l Iron Pig (Cleveland warrants) .. per ton	51/6	..
„ Wire, galv. No. 8, P.O. qual. „	£14	..
g Lead, English Pig .. .. .. „	£20 7 6 to £20 10	2/6 to 5/- inc.
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. per bot.	£7 10	..
e Mica (in original cases) small .. per lb.	6d. to 8s.	..
e „ „ „ medium „	8/6 to 5/-	..
e „ „ „ large .. „	7/6 to 11/-	..
o Nickel, sheet, wire, &c. .. .. „	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings „	1/1 to 1/3½	..
p „ „ rolled bars & rods „	1/0½ to 1/2	..
p „ „ rolled strip & sheet „	1/2½ to 1/5½	..
o Platinum .. .. per oz.	186/-	..
d Silicium Bronze Wire .. .. per lb.	10½d.	..
r Steel, Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. .. „	£175 to £176	£1 5 inc
n „ Wire, Nos. 1 to 16 .. .. per lb.	2/4	..
p White Anti-friction Metals .. per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.) „	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

International Engineering Congress, 1915.—Rapid progress is being made in working out the final programme of papers for the International Engineering Congress to be held in San Francisco in 1915. The first volume of the publication of the Congress will consist of a series of articles descriptive of the various technical features of the design and construction of the Panama Canal, and will constitute an official technical record of the gigantic engineering feat which is just nearing completion. The programme of papers for the various sections of the Congress is practically completed, and notices of them will be published in the near future. Subscriptions to the Congress are being received daily, and on March 1st the number of enrolments was slightly over 1,200. It is hoped that all engineers interested in the success of the Congress will send in their subscriptions as early as possible.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations March 17th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	⅞ — 1⅛	..	Nil
Do. 5 % Pref.	1	5	5	⅞ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	15½ — 17½	..	..
Do. Do. Deferred	100	..	..	6⅛ — 8⅛	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	8	..	56 — 59	..	5 1 8
Do. 5 % Perp. Deb.	100	5	5	95 — 98	..	5 2 0
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 86	..	5 8 5
Central London Railway, Ord.	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 5
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Def.	100	2	2	57 — 62	..	3 4 6
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	95 — 97	..	5 3 1
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	⅞ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	67 — 72	..	6 5 0
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb.	100	5	5	86 — 88	+1	5 13 8
London and Suburban, Ord.	1	..	..	3/32 — 5/32	—1/32	..
Do. Do. 5 % Cum. Pref.	1	..	5†	3/32 — 5/32	..	6 13 4
Do. Do. 4½ % 1st Deb.	100	4½	4½	79 — 84	..	5 7 2
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	63 — 67	..	5 19 5
Metropolitan Railway Consol.	100	1⅜	1⅜	40⅜ — 41½	—1/2	3 18 9
Do. Surplus Lands	100	2⅜	2¾†	62 — 64	—1	4 6 0
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82 xd	..	4 5 4
Metropolitan District Ord.	100	Nil	..	28 — 28⅛	—1/2	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	85 — 88	—1	5 2 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	89 — 92	—2	4 17 9
Do. 5 % Deb.	100	5	5	88 — 91	—1	5 10 0
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	⅞ — 31/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	3 — 3⅛	—⅛	Nil
Do. "A"	1/-	..	..	3/32 — 1/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 —114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 0
Do. 6 % Income	100	6	6	88 — 89	—1	6 14 10
Yorkshire (West Riding). Ord.	5	Nil	..	5/16 — 3/8	..	Nil
Do. 6 % Pref.	5	3	4	4 — 4½	+⅛	4 9 0
Do. 4½ % Deb.	100	4½	4½	83 — 86	+2	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅛ — 5⅛	..	5 8 7
Do. 2nd Pref.	5	5½	5½	4⅝ — 4⅞	..	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅝ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94⅛ — 96½	..	4 18 8
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	82⅞ — 84½	—3/4	7 2 0
Brisbane Trams Invt., Ord.	5	8	8	7⅞ — 8½	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	113 —117	..	6 16 9
Do. Pref. Ord.	100	6	6	105 —109	..	5 10 1
Do. 5 % Pref.	100	5	5	101 —104	..	4 16 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	93½ — 95½ xd	..	4 9 0
Calcutta Trams, Ord.	5	7⅛	6†	6⅛ — 6⅝	..	5 11 1
Do. 5 % Pref.	5	5	5	5⅛ — 5½	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅜ — ½	..	6 18 4
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜ xd	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	⅛ — ¼	..	..
Do. Pref.	1	4⅜d.	6	1/16 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	1⅜ — 1 7/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	5 — 5⅜	..	5 11 7
„ Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	+½	4 19 6
Mexico Trams Com	$100	7	7	69 — 72	—1	..
Do. Gen. Con. 5 % Bonds	..	5	5	80 — 84	..	5 19 1
Do. 6 % Bonds	100	6	6	81 — 85	..	7 1 2
Para Elec. Rlys. & Lt., Ord.	5	10	10	4½ — 5 xd	..	10 0 0
Do. 6 % Pref.	5	6	6	4⅜ — 4⅝ xd	..	6 9 9
Do. 5 % 1st Deb.	100	5	5	92 — 94	—1	5 6 5
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	95 — 97	—2	5 3 0
Do. 5 % Mort. Bonds	100	5	5	87 — 89	—1	5 12 5
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 — 99	—2	5 1 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	—½	5 3 0
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 5½	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅜ — 5½	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	95 — 98	..	5 2 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93 — 95 xd	..	4 14 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	8⅜ — 9⅛	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10⅝	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 97	..	4 12 9
Brompton & Kensington, Ord.	5	10	10†	9 — 9⅛	..	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 9⅛	..	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	+ ½	4 4 8
Charing Cross, West End & City	5	5	6	4⅜ — 5⅛ xd	..	5 18 5
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8⅞ — 4⅜	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	17½ — 18½ xd	..	5 9 7
Do. 6 % Cum. Pref.	10	6	6	12¾ — 13⅜ xd	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 7 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 8 1
County of London, Ord.	10	6	7	12⅛ — 13	..	5 7 8
Do. 6 % Pref.	10	6	6	11⅞ — 12¼	..	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	102 —105	..	4 5 9
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	£3	..	..	3/32 — 1/8	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref.	5	..	..	1/8 — 3/16	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅛ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8⅛ — 9 xd	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7⅝ — 8 xd	..	5 12 6
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅞ — 1 15/16 xd	..	4 12 8
Do. 6 % Pref.	5	6	6	4⅛ — 5⅜ xd	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	3⅜ — 4 xd	..	5 6 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10½	..	5 14 3
Oxford	5	7	7	5 13/16 — 6 1/16 xd	..	5 11 0
St. James' and Pall Mall, Ord.	5	10	12	9½ — 10 xd	..	6 0 0
Do. 7 % Pref	5	7	7	6⅝ — 7 xd	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	5½	8 — 8⅜	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/32 — 1 5/32	+1/32	5 9 2
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	3/32 — 1/8	..	..
Do. 5 % Cum Pref.	5	3†	..	2⅜ — 2⅝	..	4 12 0
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 3
Westminster, Ord.	5	10	10	8½ — 9	..	5 11
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5½	—1/16	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 17th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	£ 5 — 5¼	..	£ 5 14 3
Calcutta, Ord.	£	8½	5†	7⅞ — 8	..	£ 5 6 3
Do. 5 % Pref.	£	5	5	5⅛ — 5⅜	..	£ 4 18 0
Calgary Power, 1st Mort. Bds. ..	100	5	5	90 — 92	..	£ 5 8 8
Canadian Gen. El. Com.	$100	7	8	113 —117	..	£ 6 16 9
Do. 7 % Pref.	$100	7	7	128 —128	..	£ 5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — 1	..	£ 7 12 0
Do. 5 % Deb.	100	5	5	90 — 93	..	£ 5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88 — 90	..	£ 6 13 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	£ 5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	£ 5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	5⅜ — 5⅝	..	£ Nil
Do. 6 % Pref.	£	6	6†	6⅜ — 6⅝	..	£ 10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	£ 4 16 2
Madras, Ord.	£	Nil	..	1½ — 1⅝	..	£ ..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103½—106½	..	£ 4 14 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	67 — 72	..	£ 6 19 0
Mexican Lt. & Power, Common	$100	4	4†	40 — 43	—1	£ ..
Do. 7 % Cum. Pref.	$100	7	7	78 — 82	—1½	£ 8 10 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	80 — 84	..	£ 5 19 1
Do. 5 % 2nd Mort. Bonds ..	100	5	5	65 — 69	..	£ 7 4 11
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	*	1919.	1913.			£ s. d.
	100	5	5	£ 54 — 59	..	£ .. ..
Montreal, Lt., H. and Power ..	$100	9	10†	230 —235	..	£ 4 5 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	£ .. ..
River Plate, Ord.	Stock	10	..	235 —245	..	£ 4 1 8
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	103 —108	..	£ 5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	£ 4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 —104	..	£ 4 6 7
Shawinigan Water, Capital ..	$100	5½	6†	138 —142	—4	£ 4 4 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	£ 4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	£ 4 8 3
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	96 — 99	..	£ 4 11 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	£ 5 11 1
Victoria Falls Power, Pref. ..	1	6	6	⅞ — ⅞	..	£ 7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	100 —102 xd	..	£ 5 17 8

MANUFACTURING COMPANIES.

Aron, Ord.	£ 1	7	..	3⅜ — 3⅞	—1/32	£ 8 5 0
Do. 6 % Pref.	£ 1	6	6	2 — 2⅛	..	£ 6 17 2
Babcock & Wilcox	£ 1	16	14†	3⅛ — 3⅜	..	£ 5 18 6
Do. Pref.	£ 1	6	6	1⅝ — 1⅞	..	£ 4 3 6
British Aluminium, Ord. ..	£ 1	..	..	1⅜ — 1½	..	£ ..
Do. 6 % Cum. Pref.	£ 1	6	6	3⅞ — 3¼	+1/32	£ 6 3 10
Do. 5 % Prior Liens Debs. ..	100	5	5	96 — 99	..	£ 5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	..	£ 5 7 6
B.I. & Helsby Cables	£ 5	10	13	9⅜ — 10⅛	..	£ 4 19 1
Do. Pref.	£ 5	6	6	5⅞ — 6⅜	..	£ 4 14 1
Do. Deb.	100	4½	4½	102 —105	..	£ 4 5 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	£ 4 15 9
British Westinghouse, Pref. ..	£ 2	Nil	..	1⅞ — 1⅝	..	£ Nil
Do. Deb.	100	4	4	68⅛ — 71⅛	+ 1/2	£ 5 11 11
Do. 6 % Prior Lien	100	6	6	102 —105	..	£ 5 14 6
Browett, Lindley, Ord.	£ 1	..	..	2/- —3/-	..	£ Nil
Do. Pref.	£ 1	..	..	8/- —8/6	..	£ Nil
Brush, 7 % Pref.	£ 2	Nil	..	0 — ¼	..	£ Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	80 — 85	..	£ 5 17 8
Lo 4½ % Deb.	100	4½	4½	39 — 43	..	£ 10 9 6
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	£ 16 13 4
Callender's Cable	£ 5	15	5†	11⅛ — 12⅛	..	£ 6 2 4
Do. Pref.	£ 5	5	5	4⅝ — 5⅛	..	£ 4 16 5
Do. Deb.	100	4½	4½	97 —100	..	£ 4 10 0
Castner-Kellner	£ 1	20	22½	2⅛ — 2⅜	—3/32	£ ..
Do. Deb.	100	4½	4½	103 —106	..	£ 4 5 1
Crompton & Co., Deb.	100	5	5	83 — 85	..	£ 5 17 8
Dick, Kerr	£ 1	Nil	..	⅜ — ⅝	+1/16	£ .. ..
Do. Pref.	£ 1	6	6	⅞ — ⅞	..	£ 7 2 2
Edison & Swan, A, £2 paid	£ 5	Nil	..	1/16 — 1/8	..	£ Nil
Do. fully paid	£ 5	Nil	..	1 — 1½	..	£ Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	£ 6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	£ 7 7 1
Electric Construction	£ 1	5	..	3/16 — 3⅛	..	£ 7 12 6
Do. Pref.	£ 1	7	7	⅛ — 1 1/16	..	£ 6 11 7
Greenwood & Batley, Pref.	£ 10	7	7	6½ — 7½	..	£ 9 13 2
Do. Deb.	100	5	5	92 — 94	..	£ 5 6 5
General Electric, 6 % Pref.	£ 10	6	6	10¼ — 10⅝	..	£ 5 14 3
Do. Deb.	100	4	4	86 — 90	..	£ 4 9 0
Henley's, Ord.	£ 5	15	20	18½ — 14½ xd	— ½	£ 6 17 11
Do. Pref.	£ 5	4½	4½	4⅜ — 5 xd	..	£ 4 10 0
Do. Deb.	100	4½	4½	101 —103	..	£ 4 7 5
India-Rubber, G. & T.	£ 10	7½	7½	10½ — 11½	..	£ 6 10 5
Do. Pref.	£ 10	5	5	8⅞ — 9½	..	£ 5 5 3
Telegraph Construction	£ 12	20	20	37½ — 39½ xd	..	£ 6 1 7
Do. Deb.	100	4	4	98 —100	..	£ 4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	£ 5 16 0
Do. B 4 % Cum. Pref. ..	100	..	..	50 — 55	..	£ .. ..

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£ 10	4½	4½	6⅛ — 6⅜	..	£ 6 13 4
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	£ 5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —126	..	£ 6 7 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	£ 4 5 3
Anglo-American Telegraph ..	Stock	3	3	64 — 67	..	£ 4 9 7
Do. 6 % Pref.	Do.	6	6	108½—109½	..	£ 5 9 4
Do. Def.	Do.	80/-	80/-	23¾ — 24¼	+ ¼	£ 6 3 9
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104 xd	..	£ 4 16 2
Chili Telephone	£ 5	8	..	7⅞ — 7⅞	..	£ 5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81¼ — 83¼	..	£ 4 16 0
Cuba Telegraph	£ 10	6	6†	8⅞ — 9⅜	..	£ 6 3 1
Do. 10 % Pref.	£ 10	10	10	15½ — 16½	..	£ 5 19 5
Direct Spanish Telegraph, Ord.	£ 5	4	4	3¾ — 4	..	£ 5 0 0
Do. 10 % Cum. Pref.	£ 5	10	..	7¼ — 8	..	£ 6 5 0
Direct United States Cable ..	£ 10	4	4†	6⅞ — 7⅛	..	£ 5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	£ 4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	133 —136	..	£ 5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	£ 4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	£ 4 2 4
Eastern Extension	£ 10	7	7	12⅜ — 12⅝	..	£ 5 8 9
Do. 4 % Deb.	Stock	4	4	94 — 96	..	£ 4 3 4
Globe Telegraph and Trust ..	£ 10	6	6†	11⅜ — 11⅝	— ⅛	£ 5 1 1
Do. 6 % Pref.	£ 10	6	6	13½ — 13	..	£ 4 12 4
Great Northern Telegraph ..	£ 10	20	5†	32 — 34	— ½	£ 5 17 8
Indo-European Telegraph ..	£ 25	13	5†	58 — 60	..	£ 5 8 4
Mackay Companies Common ..	$100	5	5	85 — 89 xd	..	£ 5 12 4
Do. 4 % Cum. Pref.	$100	4	4	70 — 73 xd	+1	£ 5 9 7
Marconi's Wireless Telegraph ..	£ 1	20	20	3⅛ — 3⅜	— ⅛	£ 5 10 4
Do. 7 % Cum. Partic. Pref. ..	£ 1	17	..	2⅜ — 3⅛	—1/16	£ 5 10 3
Monte Video Telephone, Ord. ..	£ 1	6	6	⅞ — 1	..	£ 6 8 0
Do. 5 % Pref.	£ 1	5	5	⅞ — 1	..	£ 5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99½ — 100⅞	..	£ 4 9 0
Oriental Telep. and Elec. ..	£ 1	10	10†	2 — 2⅛	..	£ 4 9 0
Do. 6 % Cum. Pref.	£ 1	6	6	1⅜ — 1½	..	£ 4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	£ 4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	£ 4 0 0
Reuter's	£ 10	10	10†	8¼ — 9½	..	£ 10 16 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	£ 4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½ — 98½	..	£ 4 11 5
United River Plate Telephone	£ 5	8	6†	6⅜ — 6⅞	..	£ 5 16 5
Do. 5 % Cum. Pref.	£ 5	5	5	5⅛ — 5⅝	..	£ 4 9 0
West Coast of America	£ 2½	2½	..	1 1/16 — 1 1/16	..	£ 4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	£ 4 0 10
West India and Panama Teleg.	£ 10	1½	1½	2⅞ — 2 11/16	..	£ 4 13 0
Do. 6 % Cum. 1st Pref. ..	£ 10	6	6	9¼ — 10⅜	..	£ 5 17 0
Do. 6 % Cum. 2nd Pref. ..	£ 10	6	6	9 — 9⅝	..	£ 6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	£ 5 1 0
Western Telegraph, Ltd. ..	£ 10	7†	7	13⅜ — 13⅞	+ ¼	£ 5 0 11
Do. 4 % Debs.	Stock	4	4	95 — 97	..	£ 4 2 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 98	..	£ 4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Swiss Trade in 1913.—Uniform development was far from being the characteristic of the Swiss machinery industry in 1913, says a report of the Schweizer Kreditanstalt. While some works were well, and others even over-employed, the majority, and especially those connected with the building trades, felt the effects of the prevailing economic depression. Export figures showed few important alterations as compared with those of the previous year, but new business was hard of arrangement, and old connections were adversely influenced by restrictions and postponements. Notwithstanding that raw materials and partly manufactured articles were a trifle lower in price, exporting firms found it difficult to secure prices for their products on the world-market corresponding to their value. Manufacturers in the electrical industry in 1913 were well employed. Towards the close of the year a certain shrinkage in the orders from Germany was apparent, synchronising with declining prices. The latter tendency has not hitherto been felt in Switzerland, and possibly would not have been, had not the slump in Germany lasted so long. Great anticipations continue to be entertained in connection with the introduction of electric working on the Swiss railways.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING FEBRUARY, 1914.

THE electrical export business during February last makes a poor showing in comparison with the January figures, the February total of £439,241 being about £115,000 down.

This result is traceable almost entirely to the falling-off in electrical machinery exports, which, it may be remembered, reached a record value in January, for in other directions the export returns show an improvement on the whole.

The machinery exports, despite their fall, are but slightly under last year's average; the cable, telephonic material and lamp exports reached higher values, and telegraphic and fittings exports lower values, than in the previous month.

The February imports reached a total of £270,944, which compares with £258,175 in the previous month, the increase in the total being due to somewhat higher values in the goods, cable, lamp, machinery and carbon sections, which were accompanied by a comparatively small falling-off in other directions.

The re-export total, £25,297, was nearly £3,000 lower than the previous month's figure.

As in the previous month, India was by far the best customer of this country, while business with our colonies, as usual, and with Japan, Argentina, Brazil and France reached satisfactory proportions. German imports were on a higher scale than in January, while the other prominent importer, the U.S.A., showed a falling-off in business.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,766	149	537	47	3,002	1,029	5,256	79	521	15	7	2,581	14,989
Germany	1,169	851	73	...	490	53	2,545	...	67	...	108	351	5,707
Netherlands, Java and Dutch Indies ...	925	825	247	12	...	...	550	...	26	28	1,536	254	4,403
Belgium	1,332	219	220	...	335	118	1,201	...	173	...	2,160	89	5,847
France	956	...	4,254	26	...	...	12,641	4,346	10	126	31	14	22,404
Portugal	33	10	...	...	...	16	31	5,474	12	2	2,467	155	8,200
Spain, Canary Isles and Spanish N. Africa...	1,546	125	60	10	...	399	3,263	...	4	...	299	2,274	7,980
Switzerland, Italy and Austria-Hungary ...	378	86	262	...	167	400	2,294	670	...	417	12	263	4,949
Greece, Roumania, Turkey and Bulgaria ...	367	...	93	26	...	...	622	...	...	...	934	202	2,244
Channel Isles, Gibraltar, Malta and Cyprus...	45	...	53	49	32	...	60	...	...	...	6	15,600	15,845
U.S.A., Philippines and Cuba	902	102	...	671	203	...	1,130	64	3	...	...	2,338	5,413
Canada and Newfoundland	640	542	551	459	13	2,034	7,067	537	190	21	108	265	12,427
British West Indies and British Guiana ...	71	...	266	141	...	63	100	...	13	...	123	49	826
Mexico and Central America	16	228	...	107	...	...	264	1,350	...	...	124	82	2,171
Peru and Uruguay	176	119	39	203	...	154	1,021	...	80	...	3	213	2,008
Chile	733	33	131	122	...	...	706	2	5	3	60	44	1,839
Brazil	1,779	128	753	13	...	35	10,521	2,837	1,243	6	3,049	1,169	21,533
Argentina	3,025	11,063	906	1,611	1,048	526	7,892	16	1,674	6	3,074	1,419	32,260
Colombia, Venezuela, Ecuador and Bolivia...	59	...	...	...	...	...	877	...	...	3	99	...	1,038
Egypt, Tunis and Morocco	458	1,168	56	27	...	139	1,054	114	71	...	490	1,031	4,608
British West Africa	21	200	89	52	...	22	705	5	103	...	280	28	1,505
Rhodesia, O.R.C. and Transvaal	731	622	1,266	227	...	160	3,561	...	62	17	51	135	6,832
Cape of Good Hope	1,348	1,894	848	230	...	357	4,501	210	851	7	2,228	1,255	13,729
Natal	602	5,085	95	440	...	7	1,484	...	59	10	722	666	9,170
Zanzibar, Brit. E. Africa, Mauritius & Aden	621	469	29	180	...	38	510	398	80	...	509	1,524	4,378
Azores, Madeira and Portuguese Africa ...	228	188	76	53	...	195	1,864	17	137	16	...	30	2,804
French African Colonies and Madagascar ...	74	...	...	...	...	...	...	...	...	...	...	...	74
China and Siam	884	8,025	1,770	109	...	370	4,726	...	455	...	394	67	16,800
Japan and Korea	2,536	...	...	...	12	33	21,894	...	202	24	129	...	24,830
India	6,613	13,607	2,711	2,784	200	2,462	32,100	5,609	3,219	289	4,890	1,477	75,961
Ceylon	225	260	117	29	...	48	629	484	94	...	262	122	2,270
Straits Settlements, Fed. Malay States and Sarawak	311	217	516	79	87	149	3,019	1,336	96	...	810	1,390	8,010
Hong Kong	444	399	237	18	30	11	1,341	...	63	...	...	...	2,543
West Australia	238	797	111	36	...	208	1,000	47	5	...	3,180	101	5,723
South Australia	558	242	49	64	12	1,158	737	9	2	...	429	723	3,983
Victoria	2,213	5,792	484	1,241	178	1,157	3,336	652	445	...	2,241	481	18,220
New South Wales	1,832	4,013	1,626	1,039	570	1,396	15,118	446	1,916	33	3,719	2,049	33,757
Queensland	348	2,394	95	155	...	55	404	25	54	...	69	3,176	6,775
Tasmania	...	...	...	82	404	...	43	...	...	...	85	...	614
New Zealand and Fiji Islands	733	8,575	564	623	259	686	1,987	...	757	14	9,962	432	24,592
Total, £	36,936	68,427	19,184	10,965	7,042	13,478	158,054	24,727	12,692	1,037	44,650	42,049	439,241

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	7,045	...	24	...	...	...	4,009	5	818	38	10,844	22,783
Germany	4,115	25,505	1,648	14,670	8,659	4,377	72,589	1,228	5,343	12,910	8,590	159,634
Holland	...	53	...	624	409	...	77	...	...	34	14	1,211
Belgium	326	5,631	...	105	53	50	3,645	...	264	49	5,548	15,671
France	1,074	4,595	58	1,940	265	1,751	1,882	...	800	3,723	1,520	17,608
Switzerland	426	916	23	10	...	625	1,958	40	...	115	183	4,296
Italy	...	3,781	...	219	...	...	144	...	...	206	17	4,367
Austria-Hungary	4	1,087	...	...	16	...	321	...	90	...	...	1,518
United States	11,130	112	1,736	...	245	...	12,594	14,477	711	189	1,750	42,944
Total, £	24,120	41,680	3,489	17,568	9,647	6,803	97,219	15,750	8,026	17,264	28,466	270,032

Additional imports: Spain, carbons, £662; Canada, electrical goods, £250.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	11,047	1,736	...	1,243	205	...	6,306	...	200	543	814	25,297

TOTAL EXPORTS: £439,241. TOTAL RE-EXPORTS: £25,297. TOTAL IMPORTS: £270,944.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE ALL-ELECTRICAL OPERATION OF THE PANAMA CANAL.

By JOHN GEO. LEIGH.

(*Concluded from page* 366.)

I am acquainted with no engineering or, indeed, other enterprise which, considered as a whole, can compare with the Panama Canal in well-justified claims to lively and world-wide interest. This is not merely because of the immensity of the undertaking and its far-reaching commercial and other material influences, but also by reason of the opportunities it presents to men of all sorts and conditions for valuable study and instruction. To no department connected with the constructive work or the use of the completed highway can this last remark be applied with greater truth than the electrical; and pre-eminently is this the case in respect of the specification, design and manufacture of the centralised control, interlocking and indicating systems to which I invited particular attention in a recent issue of the Electrical Review. If, as may be confidently anticipated, these systems prove helpful to the safe and expeditious navigation of the Canal, everyone concerned in their production and installation may point to the result with pardonable pride, and say: "I helped to make this possible."

Put briefly, the systems are a triumph of co-ordination, mental no less than mechanical. Both in part and as a whole, they present startling departures from long-established practice, and cannot fail to serve for many years to come as models of painstaking engineering, thoughtful of every detail, and comprehending every safeguard and contingency which expert knowledge can suggest. The specifications for them, and generally for the generation and distribution of energy, were prepared under the supervision of Mr. Edward Schildhauer, the Canal Commission's electrical and mechanical engineer, assisted by a staff of accomplished electrical engineers, including Mr. C. B. Larzelere, who was closely identified with lock control problems, and Mr. W. R. McCann, who devoted himself especially to power generation and distribution. While necessarily exacting as to the high quality of the work demanded, and explicit concerning the results to be accomplished, the specifications gave unusual opportunities for the exercise of individual ingenuity and the adoption of well-considered modifications.

The General Electric Co., of Schenectady, N.Y., may well be proud of the large percentage of contracts awarded to it. By this company have been manufactured all the lock machinery motors, control panels, centralised control boards, power-station generating apparatus, switchboards, transmission line sub-station equipments, electrical machinery for the Cristobal and Balboa coaling stations, and practically the entire electrical equipment for the wharf terminal cranes and for the extensive permanent machine shops now in course of completion at the Pacific entrance to the Canal.

After the award of contracts, conferences took place between the engineers of the Commission and of the manufacturers, and, because of the absence of previous experience as a guide in the selection of designs, these were continued until there was a full understanding of the requirements, conditions and possible alternatives. Associated with or following these conferences were numerous departmental consultations, at which factory foremen, designers and engineers were represented, facilities were discussed and special tools were considered.

Preliminary plans and models were then prepared, to be modified from time to time, since no part was considered complete until the model had been critically inspected and tested by the engineers, both of the Commission and of the manufacturers, and there was a consensus of opinion that the design and operation met every condition foreseen at the time the specifications were written or subsequently revealed. A co-ordinating engineer was appointed to settle the innumerable questions arising in respect of construction, design and delivery and, generally, to relieve the departments of those complications liable to occur through long-distance correspondence. A separate manufacturing department was also organised, so arranged that its members would not be hampered by other work, and the Canal Commission was kept in touch with the progress of production by its own inspectors resident at the factory. Sufficient proofs of the value of this co-operation will be found in the expedition and close accord with the spirit of the specifications with which the contracts have been fulfilled.

The following classified summary of the various apparatus employed in the control system described in the preceding article—towards the preparation of which the General Electric Co. contributed much information and most of the illustrations—may be of interest:—

Control Switchboards.

One each, with control switches and interlocks, for the locks at Gatun, Pedro Miguel and Miraflores and the Gatun and Miraflores dams.

Starting Panels.

One hundred and sixteen for rising-stem gate-valve motors, one starting and one running point both forward and reverse; 116 similar panels for use with motors on 92 mitre-gate moving machines and 18 guard gates; 280, with one point forward and one point reverse, for use with motors on 120 cylindrical valves, 12 auxiliary culvert valves, 46 mitre-forcing machines, 80 mitre-gate handrails and 22 spillway gates.

Limit, Commutating, Overload Cut-Out, Indicator and Handrail Control Switches.

One hundred and ten limit switches for use with 92 mitre-gate moving motors and 18 guard valves; 22 limit switches, with indicator switch attachment, for spillway gates; 58 similar switches for use with 46 mitre-forcing machines and 12 auxiliary culvert valves; 80 limit switches for use with handrail motors on mitreing lock gates; 92 commutating switches, half for use with right hand and half with left hand mitre-gate moving machines; 92 auxiliary cut-off switches for mitre-gate struts, right hand and left hand; 200 indicator switches for attachment to limit switches on 120 cylindrical valve machines, 46 mitre-forcing machines, 12 auxiliary culvert valve machines and 22 spillway gate machines; 80 handrail controllers, foot-operated.

Fender Chain Control Apparatus.

Forty-eight starting panels for 50-h.p. pump motors operating fender chains; 48 operating valve control equipments; 48 limit switches; 48 indicating devices for showing position of chain to those in vicinity of the chain itself; 46 indicating devices for showing on the control switchboard at all times the position of chain.

Miscellaneous Remote Indicators.

Two hundred red and green lamp indicators, mounted on control board and operated by switches; 226 indicators, giving progressive or synchronous indication—92 for mitre-gate moving machines, 116 for rising-stem gate valves and 18 for guard valves; 46 float well indicators, including float and machinery at well and indicator mounted on switchboard.

It is interesting to note that in the course of manufacturing operations the General Electric Co. made no fewer than 1,750 special drawings, and that into its work there entered in various quantities over 22,000 individual parts. Up to November 1st, 1913, 73 carloads of switchboard material alone had been shipped to Panama. The following list of approximate quantities will give some idea of the extent of the undertaking:—

Special slate bases	1,300
Small castings	160 000
Screw machine parts	1,200,000
Copper rod and bar	58,000 ft.
Asbestos lumber	9,000 sq. ft.
New patterns	650
New jigs, templates, tools, &c.	625
Porcelain parts	18,000
Special bus supports	6,800
Gal. pipe (framework)	21,000 ft.
Special gears	2,300
Special indicator motors	730
Special instruments	642
Miscellaneous sherardised pieces	300,000
Cases for boxing	4,150

The combined weight of the centralised control boards at Gatun, Pedro Miguel and Miraflores locks is about 39 tons, and in their construction there were employed more than two miles of interlocking rod, about 6,000,000 ft. of control leads, 732 indicator motors and 464 control switches.

The 246 miles of lead-covered cables required for the control and power systems of the locks, and the 112 miles of wire of miscellaneous sizes used for the lighting system, are carried in vitrified clay ducts through tunnels in the lock walls provided for the purpose. By employing electric winches and by greasing the cable at three points to reduce friction, it was found possible to pull at one time 900-ft. lengths of the lead-covered line, and thus reduce greatly the time demanded for the operation. One of the "records" established was that reported from Miraflores in July last, when, in a single working day of eight hours, there were pulled into the ducts of one of the lock walls 7,444 ft. of 5-conductor and 10,000 ft. of 8-conductor cable. This, however, was beaten two months later by a cable gang working at Gatun, who succeeded in pulling a total of 22,128 ft. during a working day marked by incessant rain. The best record for any one month is 113,002 ft.

As the motors applied to the machinery in the locks require electrical service at 240 volts, transformer units are needed, possessing a 9 to 1 ratio, to link the power circuits from the generating station to the mains feeding the motors. The feeders entering a lock at either extremity are equipped with transfer switches to admit of isolation, and so provide separate service to the machinery of any of the lock chambers or any of the lock walls. In each of the latter, duplicate feeders are run to the different transformer rooms, the high-tension buses of which are looped into the feeders and provided with sectionalising switches to permit of the cutting-out of all high-voltage conductors from a seat of trouble between any two rooms.

Each of the transformer rooms is practically a self-contained sub-station (fig. 23). In all the locks there are 36

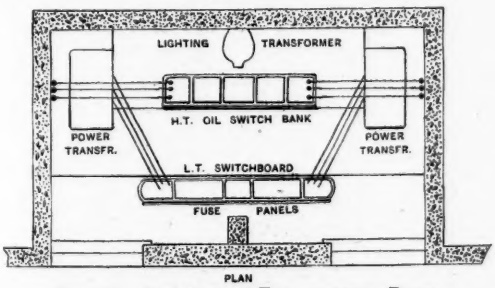


Fig. 23.—Lay-Out of Transformer Room.

such rooms—16 at Gatun, 8 at Pedro and 12 at Miraflores. At Gatun, for example, there are four rooms in each of the side walls and eight in the centre wall, these last being so arranged as to separate the equipment required for one lock chamber from that of the other. In each of the walls, the transformer rooms are grouped near the centres of power distribution adjacent to the great mitreing gates at each end of a lock, the result being minimum energy losses in the low-tension mains.

The transformer-room equipment includes duplicate power transformers, each of approximately 200 KW. capacity; a single lighting transformer, of 25 KW. capacity; an oil-switch bank, containing ten single-throw oil switches; a seven-panel distribution switchboard, containing 12 power switches, and a panel of lighting equipment.

The power transformer is of the air-cooled, oil-insulated type, designed to operate upon a three-phase, 25-cycle circuit, and furnishing a normal pressure transformation of 2,200 volts to 240 volts. The case is of corrugated steel sheet, with cast-iron base, top rim and cover, the core and windings being immersed in a freely circulating oil. The rating is such that either of the units is capable of carrying the entire load on the transformer room, the second transformer being a duplicate and in reserve. In normal operation, however, the mains connected to the locomotive track will be loaded probably upon one transformer, while those to the machinery motors will be connected to the second. In the event of a breakdown of either transformer or feeder, the mains can be transferred quickly to the alternative transformer. The lighting transformer is very similar to the power transformer, but of smaller capacity and single-phase instead of three-phase. The purpose of this transformer is to take single-phase energy from the primary feeders at 2,200 volts between wires and transform it to energy at 220-110 volts for the three-wire Edison service to about 7,000 lamps distributed throughout the locks.

The oil-switch bank (fig. 24) consists of 10 single-throw oil switches mounted upon a rigid pipe framework, the oil switches being connected to the transformers and the feeders.

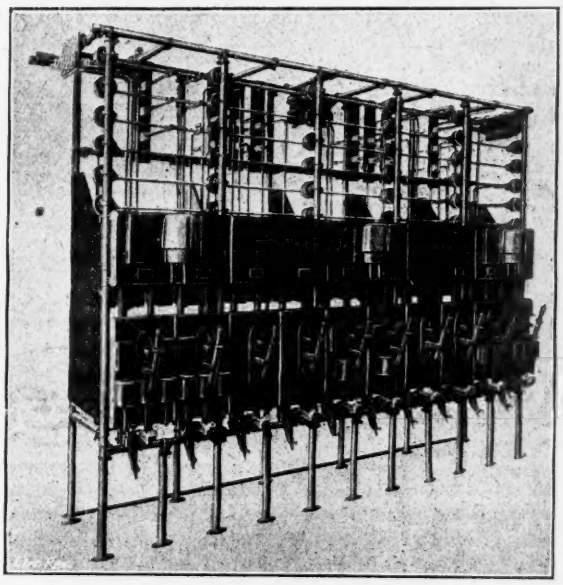


Fig. 24.—2,300-volt Transformer Switchboard for Canal Locks, showing Oil-Switch Disconnecting Switches, and Oil-Switch Panels.

Three-pole switches are required for power purposes, and two-pole for lighting. Double-throw switches on the transformers are obtained by connecting a common lead to two adjacent studs of single-throw switches. Overload protection is provided for by means of current transformers, inverse time-limit relays and tripping coils; and, in order to protect attendants against accidental contact with dangerous potentials, special pains have been taken to make the equipment safe and "fool-proof." All conductors are well-insulated, and screens surround them and the buses as protection against mechanical injury.

To overcome one particularly dangerous operating feature, a special design has been resorted to. In the maintenance of oil switches it is necessary at intervals to clean out the oil and inspect the contents. Owing to methods of construction, it is then often possible that the contact studs are charged to an unsafe potential. The usual practice of inserting knife-blade disconnecting links in each of the leads to the oil switches is satisfactory where the installation is isolated, and the inspection and repairs occur at rare intervals. In the limited space of the lock transformer rooms, however, the large number of knives necessary assumes cumbersome dimensions. A one-link lever attachment has accordingly been adopted to drop and disconnect the entire switch—can, insulators, studs, slate and handle—from stationary contacts rigidly secured to the pipe framework. The operation of this device, which may serve as the solution to a knotty problem to many central-station designers and engineers, is illustrated in figs. 25 and 26, p. 508.

These show a manually-controlled oil switch, A being the pot containing oil, in which are immersed the contact studs (B) and the contact blade (C). The electric current ordinarily passes from one external conductor (D) through the contact studs and blade, and out by the other conductor (E). To interrupt the flow of current, the blade is lowered by means of the operating levers (F), which are controlled by the handle (G), mounted upon a slate panel (H) in front of the switch, the entire unit being supported upon a pipe

framework (J). When it is necessary to inspect the switch, the pot is dropped, and the contacts are exposed. Should, however, these contacts be "alive," the attendant is obviously unable to make the repairs with safety, and it is to ensure

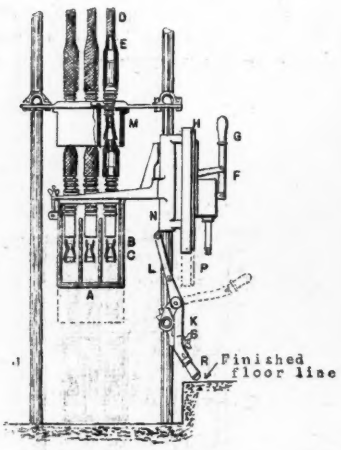


FIG. 25.—DETAILS OF DISCONNECTING DEVICE.

A, Oil pot; B, Contact studs; C, Contact blade; D, E, External conductors; F, Operating levers; G, handle; H, Slate panel; J, Pipe framework; K, Disconnecting lever; L, Link; M, Stationary contact studs; N, Cross-head; P, Brass guides; R, Handle; S, Wing nut.

knowledge that they are "dead" that the new disconnecting device has been provided.

As already stated, this contemplates a dropping of the entire switch by means of the lever K, which is connected through a link (L) to the bracket carrying all parts of the switch. Stationary contact studs are provided on the conductors at M, and the oil-switch studs are made double-ended so as to make contact at both the lower and upper ends. The oil-switch bracket is bolted to a cross-head (N), which rides vertically upon brass guides (P). By raising the handle (R), the entire oil-switch and operating mechanism are lowered bodily away from the stationary studs and the circuit at M is broken. When once the switch is dropped,

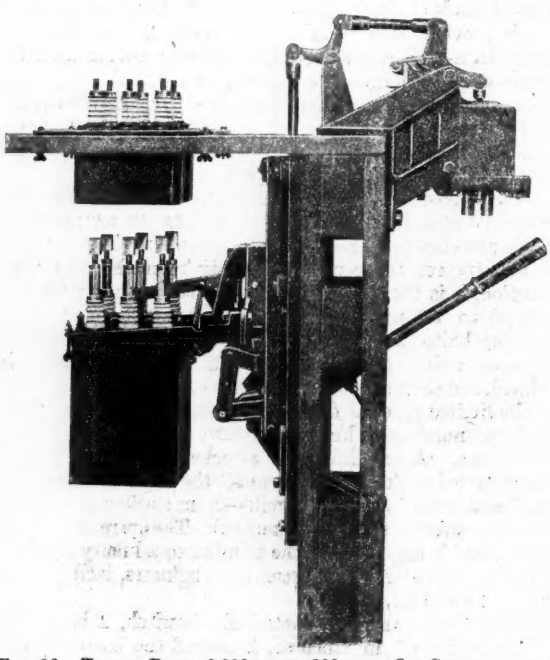


FIG. 26.—TRIPLE-POLE, 2,200-VOLT, 300-AMP. OIL-SWITCH, WITH SOLENOID OPERATING MECHANISM AND DISCONNECTING DEVICE; CIRCUIT OPEN.

the attendant may repair or renew any part without danger to his person. Though the opening of the switch under oil is a frequent operation, the dropping of the entire can will be required comparatively seldom, and there will be consequently little need of renewals at the stationary contacts. Adjustments for alignment are provided in the brass guides, in the plate supporting the stationary studs and in the individual switch contact studs. The disconnecting lever, when not in use, is maintained in position by a wing nut (S), the handle being removable.

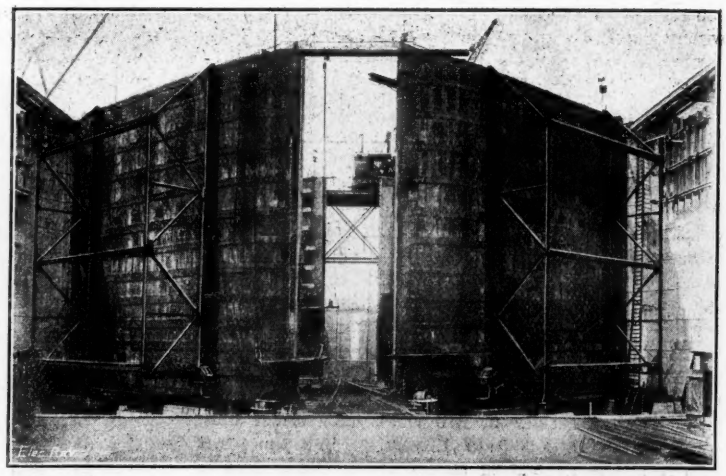


FIG. 27.—UPPER GUARD GATES AT PEDRO MIGUEL LOCKS.

There will be in all the locks 372 oil switches, their rating being 300 amperes at 2,200 volts and 25 cycles. As the oil to be used is to serve as an insulating medium and to quench arcing at contacts, the requirements of break-down voltage are somewhat severe. For this reason, the specifications covering the oil and the method to be adopted in testing it are exceptionally rigorous.

The distributing switchboard consists of seven panels of 2-in. slate, six panels being used for mounting 12 power switches and one for lighting switches and circuit breakers. The power switches are of a three-pole, double-throw, double-blade, back-connected lever type, rated at 600 amperes. The switchboard is built upon a pipe framework, each switch being fused upon small panels mounted upon the framework in the rear of the board proper. From the fuses, copper bar connections are provided to the cable terminals. The distributing mains consist principally of No. 0000 B. & S. gauge, three-conductor, lead-covered cable.

The following are among the more important contracts awarded by the Canal Commission in connection with the electrical operation of the Canal :—

General Electric Co.—118 motors for rising-stem valve machines	$78,425
122 motors for cylindrical valve machines	42,991
12 motors for auxiliary culvert valve machines	4,234
92 motors for mitre-gate moving machines	46,422
46 motors for mitre forcing machines	13,569
Steel rail, &c.	73,639
40 towing locomotives	528,680
Starting panels, limit switches, commutating switches, &c., indicators for control machinery, switchboards and control switchboards, starting panels for chain fenders	199,631
Motors	110,260
60 pumps (Cameron)	26,921
308 float switches and starters	13,822
170,000 ft. insulated cable	132,028
Generators, exciters, &c., for Gatun hydro-electric station	54,599
Cutler-Hammer Manufacturing Co.—116 limit switches for rising-stem valve machines	5,684
120 limit switches for cylindrical valve machines	5,880
Westinghouse Electric and Manufacturing Co.—Porcelain insulators	5,858
Roller trains, sealing devices, rocker bearings, rollers, &c., at locks and spillway dams	177,147
Shawmut Clay Manufacturing Co.—Vitrified tiles, mandrels, &c.	85,350
Wheeling Mold and Foundry Co.—Copper conductor rails and bars	168,423
Pelton Water-Wheel Co.—Penstocks for hydro-electric station	24,530
Turbines, governors, headgates, &c.	70,012
U.S. Steel Products Co.—Cross-bonds, punches, riveting hammers, locknuts, &c.	2,014
Crossovers and turnouts	44,142

National Electric Supply Co.—Galvanised conduit, bushings, &c....	$2,055
Pennsylvania Flexible Metal Co.—Flexible conduit and couplings	4,466
Union Switch and Signal Co.—Local indicating devices for fender chains	10,800
Alberger Pump Co.—147 pumps	21,860

Brief reference should be made here to the electric towing locomotives which will be employed to control and hold steady, between four lines of taut hawsers, all vessels during their passage through the locks. In the Electrical Review of February 9th, 1912, there appeared an illustrated description of the locomotive designed for the Canal Commission, followed by an announcement that the latter had accepted the tender of the General Electric Co. for the supply of 40 such locomotives—one sample and 39 others if the first proved satisfactory. Tests conducted at Gatun Locks during the early part of last year having demonstrated that the sample machine failed to realise all the expectations of its designer, the Commission decided to abandon the proposed double truck, and accept an alternative single-truck design submitted by the contractors, subject to the following modifications, which the tests showed to be desirable:—Omission of solenoid operating clutches and friction gear, addition of hand-operating clutches and equalised hand-brakes, the fitting of springs to the thrust guide-wheel, and a change in the windlass. These modifications have resulted in a net addition to the cost of each locomotive of about £318, making the total cost of the 40 machines £109,000.

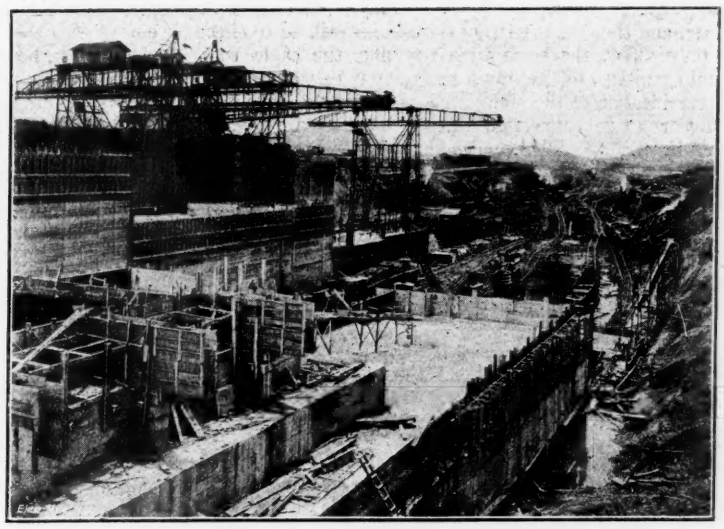


Fig. 28.—Electric Cranes at Miraflores Lower Docks.

THE GOTT SYSTEM OF TELEGRAPHING THROUGH LONG SUBMARINE CABLES.

Just over a year ago, the announcement was made in our columns that Mr. John Gott, chief electrician of the Commercial Cable Co., to whose decease we refer elsewhere in this issue, had succeeded in solving a problem of the utmost importance to cable telegraphy—namely, that of sending Morse signals through long submarine cables with some approach to the facility enjoyed in transmission over land circuits.

In the *Scientific American* of November 22nd, 1913, Mr. H. T. Wade gave a full description of the Gott system, which promises to produce radical changes in handling the ever-growing traffic carried over the cables of the world. We are indebted to this article for the following particulars.

By the new method manual re-transmission at the cable or land ends is obviated; the siphon recorder gives place to an ordinary Morse recorder or sounder, with a corresponding increase of accuracy in transmission and saving of time in deciphering the received message; and a number of short cables can be linked up for direct working, while long land-lines can be connected directly to a cable system, all messages being automatically relayed to practically any distance. The sending of signals over long cables can be effected by an ordinary telegraphist with a single Morse key, instead of the double key of manual cable working, and a Wheatstone or other similar automatic transmitter may be introduced in case increased speed is desired. Consequently the new method establishes uniformity of operation between land and submarine lines, and makes possible the fullest and most rapid interchange of traffic.

The invention was the result of many years of experimentation on the part of Mr. Gott. In addition to daily use between London and New York, special demonstrations were made of direct communication between San Francisco and London, as well as between the latter city and Montreal, Toronto, Winnipeg, Victoria and Bamfield, B.C., on the coast of Vancouver. Although the new method is one of extreme simplicity, and requires no other apparatus or instruments than may be found at any cable terminal or testing station, it affords the solution of a problem that has held the attention of cable electricians for many years.

Hitherto, even using the most sensitive instruments, it has not been possible with a long cable so to interrupt the electric current as to form signal impulses of greater or less length, such as the dash and the dot, but it has been found necessary to distinguish the two elements of the signals by the direction of the current. Thus, in ordinary cable working the letter *e*, indicated in the Morse code by a dot, would be signified by a + impulse, while *t*, represented by a dash, would be a — impulse, the galvanometer or siphon recorder at the receiving station indicating such impulses by an appropriate deflection of the mirror or moving coil in one direction or the other. This, of course, would be in response to the signals of the sending operator made by depressing one or the other of two levers of the transmitting key, depending upon whether he wished to join the positive pole of the battery to the cable and the negative to the earth, or *vice versa*. In fig. 1, on page 510, we give a diagram of the ordinary method of working with the siphon recorder on the duplex system, sending and receiving at both ends of the cable simultaneously.

In essence Mr. Gott's method is exceedingly simple. The direction of the current is changed after each signal by means of a polarised relay, through which the cable is discharged. The polarised relay consists of a permanent horseshoe magnet with one of its poles divided into pole pieces, around which are fitted coils of fine copper wire. Between the pole-pieces is poised a soft-iron needle or tongue, free to move, but normally at rest. If a current passes through the coils it will strengthen the magnetism in one of the two pole pieces, depending, of course, upon the direction of its flow, causing the arm or tongue to be attracted to one side or the other. In so moving it comes into contact with one or the other of two stops and completes a local circuit, in which the direction of the current depends upon the direction of the current flowing through the coils of the relay. The application of the polarised relay in the Gott method will appear on reference to the accompanying diagram (fig. 2), which shows a cable arranged for duplex working. The cable itself is shown at *a*, and the artificial cable at *b* with its unconnected end earthed. Between the real and the artificial cable is inserted the receiving instrument v, as in the ordinary duplex system. The transmitting key *d*, however, is arranged so as to connect *e* either with *g*, as when at rest, or when depressed at *f* with *j*, as when sending a signal. Both these connections lead to the polarised relay *h*. On pressing the key the cable is put into connection with the movable tongue *h''*, and through it with one of the stops *h'*, each of which is connected with one pole of the split battery at *l* or

l', the centre of the battery being earthed at M. Thus depressing the key charges the cable with a polarity depending upon which of the stops h' the movable tongue h'' is touching. On permitting the key to return to its normal position contact is made at g, causing the cable to discharge through the polarised relay, and the direction of the current is always such that it causes the movable tongue to pass from one stop to the other, reversing the polarity of the battery connection in readiness for the next signal. Thus successive signals are always of different polarity, and the discharge from the cable is utilised to effect this reversal, at the same time restoring the cable to a neutral condition, so that rapid signalling is possible.

A modification of the sending method involves the use of a transformer in connection with the polarised relay, as shown in fig. 3. The condenser and cable are earthed directly at g' after each signal, and while the key is open. The split battery is earthed at E through the primary coil P of the transformer. The coils of the polarised relay are in connection with the secondary of the transformer S, and the contact point of the key f is connected through the movable tongue h'' with the stops that in turn are connected with the split battery. The function of the transformer is to induce in the secondary coil, which is connected with the coils of the relay, a current that will send the tongue over against one of the stops and hold it there. Releasing the key will cause a current of opposite polarity to flow through the relay, sending the tongue over against the opposite stop, as described above. An advantage claimed for this method is that on making contact with the key to charge the cable, the battery contact in the relay is reinforced at the moment the key is depressed, thus ensuring perfect transmission. To substitute for the hand key the tongue of the relay of a land line is very simple, as is shown in the diagram (fig. 4), where T takes the place of the key d. Automatic transmission is also possible, using the Wheatstone transmitter.

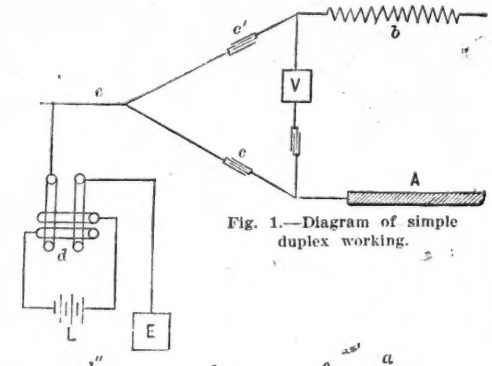


Fig. 1.—Diagram of simple duplex working.

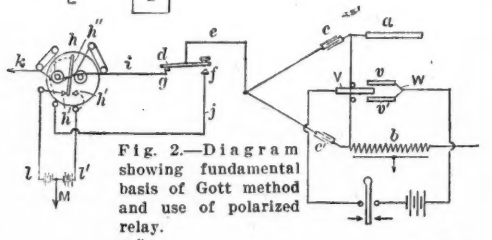


Fig. 2.—Diagram showing fundamental basis of Gott method and use of polarized relay.

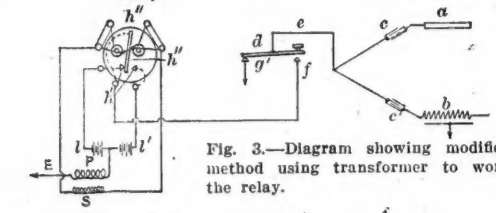


Fig. 3.—Diagram showing modified method using transformer to work the relay.

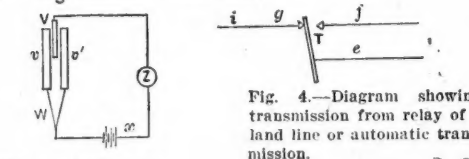


Fig. 5.—Diagram of receiving instrument and circuit.

Fig. 4.—Diagram showing transmission from relay of a land line or automatic transmission.

To understand the receiving system the diagram (fig. 5) should be examined in connection with that of the sending station. At V, where the siphon recorder ordinarily is placed, a similar instrument provided with a contact-making tongue attached to the moving coil is used. This tongue or arm makes contact with either v or v', depending upon the polarity of the current coming through the cable. These plates in the instrument are connected at W and are in circuit with the local battery x, and a sounder or recorder at Z, which, however, may be a relay or any desired instrument. While the contact piece at V will move from one side to the other depending upon the polarity of the arriving current, the effect on the local circuit will be the same in either case, and the dot or dash is sounded or recorded just as in ordinary Morse working.

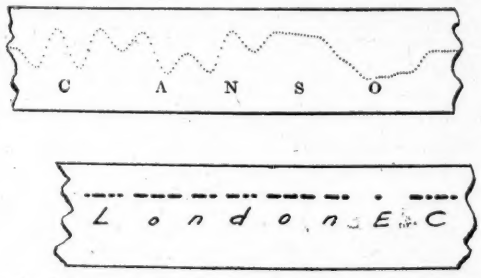


Fig. 6.—Tape of Siphon Recorder compared with Morse Tape

From this outline description it will be evident that these various arrangements can be combined practically indefinitely. Relays from land lines can be used to work sections of ocean cables, and the signals from one section may be transmitted to the next and finally to a relay working a land system of practically any length. Thus, when the operator at San Francisco was communicating direct with London, his message was relayed across the United States by nine relays working over as many sections into the cable office in New York. Here the receiving relay automatically gave its message to the Gott arrangement, and the electrical signal impulses were sent on their 1,000-mile journey to Canso, Nova Scotia, there to be received and automatically sent on the long section of 2,565 miles across the Atlantic to Weston-super-Mare, where a similar retransmission through 146 miles of subterranean line took place to London, and the message from the Pacific Coast was heard in that city with the familiar click as if it were but from Manchester. Clearly a point has now been reached where no limit can be put upon the interchange of traffic up to the capacity of the individual lines and cables making up a system.

The new method affords much greater facility of working, and while it will not phenomenally increase the actual speed of transmission, it will, as in fact it has done, make submarine telegraphy more effective, accurate and uniform.

A New Cinema Target.—In recent years the cinematograph has been pressed into service with a view to introducing a certain amount of realism into low powered rifle shooting, which is obviously lacking in the stationary target, particularly that of the bull's-eye type. It is not denied that the latter plays an essential part in the training of the rifleman, but his education is by no means complete until he has acquired the mental and physical nimbleness in handling a rifle, which is acquired by snap shooting at ever-changing targets. The cinema target is an antidote to the complaint of exaggerated deliberateness; its only drawback has been the difficulty of ascertaining under normal conditions the accuracy of the shooting.

In the new system of cinema target shooting introduced by Sporting and Military Targets, Ltd., of 25, Oxford Street, W., an endeavour has been made to meet approximately the conditions outlined. Shooting takes place at a moving picture—preferably a military one—thrown on to a steel target screen; bullets capped with explosive are used; and the flashes which occur on impact, which may be of various colours to differentiate between different men, indicate approximately the correctness of the aim. The picture never stops during the length of the film, and therefore conforms to actual conditions. The apparatus is comparatively simple and inexpensive.

SOME RAILWAY CONDITIONS GOVERNING ELECTRIFICATION.

(*For abstract of paper read before the* Institution of Electrical Engineers, *by* Mr. Roger T. Smith, *see* Elec. Rev., p. 335.)

Discussion at Manchester.

Dr. E. Rosenberg said that it was necessary to show that electric locomotives could do what steam locomotives did. The author was not to be taken too literally in stating that electric locomotives had not yet been built to take the maximum load conditions; the speaker thought that if a railway company asked for tenders for such an electric locomotive, many firm quotations would be received. As far back as 1900 the problem of running electric trains at 130 miles per hour had been solved. At that time it was thought that only motors without commutators could be relied upon for such a service, but nowadays no one would hesitate to do the same service with commutator motors, using either D.C. or single-phase motors. Rotary converters of 50 periods were run with a commutator speed of 60 miles per hour. It was true that the plain series motor had only one speed at a given voltage, but the shunting of the series field had been used extensively; on the large Pennsylvania locomotives, 50 per cent. of the armature current was shunted. An extra heavy field was used at starting, and after reaching a certain speed normal field was used. If this was done in two or three steps, various economical speeds could be obtained. The motor had commutating poles, the commutating conditions were good, and not the slightest difficulty had been experienced. It had been suggested that a compound motor should be used instead of a series motor; this would not be practicable with a plain externally excited motor, and every endeavour to get speed regulation would be in the direction of compound excitation which would miss entirely the extremely good qualities of the plain series motor. It was doubtful whether anything would ever supplant the series motor. It was strange that such a line as the Manchester-Altrincham Railway should still be in the hands of the steam locomotive; no line appeared better adapted to electrification.

Mr. E. Rothwell said that if it were necessary to bring power down to ½d. per unit there was very little hope for railway electrification. He considered that in the case of electrification the railway company were the people to deal with the generation of power and not a separate supply company.

Prof. E. W. Marchant said that on the Mersey Railway, Liverpool, after 10 years, the passenger traffic had increased about five times, and this was by no means a constant quantity. A very large percentage of the soot and smoke in large towns was due to the steam railways, and electrification would do an enormous amount of good in cleansing cities. On the North-Eastern Railway the maximum acceleration at starting was 1·5 ft. per sec^2, falling off to 1 ft. per sec.^{2} steady value. The braking effort observed was 300 lb. per ton, corresponding to a deceleration of 4 ft. per sec.^{2} In the case of the Lancashire and Yorkshire Railway (Southport line) the maximum acceleration was 2 ft. per sec.^{2}, normally 1·5, and falling off to ·5 ft. per sec.^{2} The deceleration was 200 lb. per ton, representing 3·2 ft. per sec.^{2} The Liverpool Overhead Railway showed a maximum acceleration of 2·7 ft. per sec.^{2}, dropping to a steady 1·5 ft. per sec.^{2} Motors had been tried giving an acceleration of 4 ft. per sec.^{2}, but as passengers had difficulty in retaining their seats, this was reduced to the figure quoted. The maximum braking effort was about 300 lb. per ton corresponding to 4 ft. per sec.^{2}, although normally this value was about 200 lb. per ton.

Mr. Moffet said that when making comparisons of steam and electric traction care should be taken to have the same conditions in both cases. Where lines were electrified the schedules were usually made much harder, and in a paper read by Mr. Aspinall, of the Lancashire and Yorkshire Railway, it was stated that a steam engine, which normally burned about 60 lb. of coal per train-mile, consumed about 2½ to 3 times that quantity when run on an electrified line. The question arose whether an electric locomotive could be built to give service over such a wide range as the steam locomotive, which allowed great flexibility by alteration of the cut off, although sacrificing efficiency. An important factor in favour of electrification was the saving in coal, and as coal increased in price this saving would be more pronounced. In the case of the Lancashire and Yorkshire Railway, the increase in price paid for coal during last year was £90,000, and when it was stated that the usual coal bill was about £300,000, it would be realised how the price of coal was advancing.

Mr. R. Smith, in reply, said he agreed with Dr. Rosenberg that it was essential that the electric locomotive should fulfil all the conditions met by the steam locomotive. One case to which the electric locomotive was better adapted was in connection with the daily mineral traffic, of which there was a considerable amount in this country. Minerals were brought down to the sea from a considerable height above sea level, and whilst it was easy for a steam locomotive to take down a very heavy train, it was necessary to divide the empty trucks into two trains for the return journey. In a particular case where there was a run of 18 miles, and a drop of about 400 ft. to sea level, electric locomotives were replacing steam locomotives, in order that the full train of empty trucks might be returned in one journey. Regarding the motors on electric locomotives, he thought it advisable to reduce the number of types, and produce some modification of the simple series motor, which would give a wider range of operation. Suburban traffic was not profitable, and the effort of every railway was to get out to the country. The Mersey Railway was probably the most signal instance of the complete success of electrification. In the London Underground tubes, the general acceleration was 1·5 to 1·7 ft. per sec.^{2}, but the deceleration was about double that figure. The great advantage of interchange of drivers on electric locomotives was exemplified during the North-East Coast strike, when men were drawn from the sub-stations to maintain a ½-hour service. The question of the price of coal was certainly very important, but it was well to remember that whilst electrical engineers were improving matters, steam engineers were not standing still.

Discussion at Glasgow.

Mr. W. W. Lackie (Glasgow) hoped the Glasgow Subway Co. would take to heart Mr. Smith's contention that all underground passenger traffic should be by means of electrically-operated traction. As to the author's suggestion that electric tramways competed directly with railway services in many large towns, he thought it was quite agreed that a tramway undertaking was a distinct benefit to a railway company, in so far as it acted as a feeder to the railway company and increased its traffic. It struck him that instead of increasing the tramway fares, the fares ought to be reduced. He cited the case of Glasgow, where, instead of carrying a passenger half a mile for ½d., the T.C. increased the distance to 1½ miles for ½d. The increase in revenue from that reduction more than covered the cost of the reduction. Would it not pay the railway companies to reduce the first-class fares, and so increase the traffic in first-class compartments? In the Glasgow electricity department when there was a deficit of £4,000 on a year's working, they reduced the rates, and so turned the deficit into a surplus the following year. The author argued that cheap coal was a hindrance to the electrification of railways, but the price of coal in America, where electrification had been adopted, was half the price of coal in this country. It was stated that the percentage of the heat value in the coal in the bunkers returned as work done at the drawbar of the electric locomotive was only 6 per cent.; he did not see why this should not be 12 per cent., or even 15 per cent.

Mr. C. E. Cockburn, general manager of the Glasgow and South-Western Railway, pointed out that they did not in a tramway car come to a dead stop in a big station, whereas, with a railway, they had not only to bring the people in, but to take the empties out, and that made a serious difference so far as the financial side of traffic handling was concerned. He would not deny that the tramways were an adjunct to railways, for it should not be difficult to convince railways when tramway companies converted horse into electric traction and took away £500 or more of the former's weekly revenue. He was a great believer in electricity, but they had to convey large numbers of people to the coast on Saturdays, and if electric trains carried 500 persons, and the steam trains carried 1,000, they would require twice as many electric trains as the present number of steam trains, and on the present system of block sections they would be faced with a serious traffic problem. The electric railways of the metropolis were nothing else than glorified tramways. In Glasgow they had a somewhat similar problem, because they could not afford to crowd their streets with further cars.

Mr. J. M. Scott Maxwell was of opinion that the engineering profession was to blame for the lack of progress. They ought to seize every opportunity which would enable them to make a little headway against the inherent conservatism of the travelling public and more especially of the railway directors. They all knew the Board of Trade standards were, in a great measure, stumbling blocks to progress. It was up to the electrical profession to educate the Government and the people to a better sense of proportion. American engineers seemed to have reached the decision that railways should no longer generate their own power, but purchase it from power companies. That had been the evolution of electric power in the industrial world, and it seemed natural that it should also apply to the railways and especially to the electrification of terminals. This did away with the greatest part of the new capital expenditure, and should do much to lessen the fears of the directors. They were forced to accept the small headway and clearances on British railways as a serious handicap, and it seemed all the more essential that they should have stronger draw gear than the Americans, so that they might have longer trains. As to haulage, it looked as if the D.C. advocates would win. This would mean three-phase transmission to rotary converter sub-stations, where in the future economies might be effected by the substitution of mercury-arc rectifiers in place of rotaries.

Mr. Sam. Mavor (Glasgow) asked how the draw-bar pull required in long trains was affected in going round curves, and whether in the case of a long goods train, Mr. Smith would not suggest instead of one powerful leading locomotive, two or more locomotives distributed through the load, and controlled through the leading locomotive.

The Chairman (Mr. J. A. Robertson) pointed out that Mr. Smith in making the comparison between the steam locomotive and the electric locomotive, gave the relative cost of 10½d. per train-mile for steam, and 7½d. for electric locomotives, assuming the energy at one-third of a penny per unit, and then he went on to show that the difference between those two figures would not be sufficient to pay the standing charges on the cost of electrical equipment. He asked how the 10½d. and 7½d. were made up, for they knew that the cost of coal and water in the production of steam was 3d., and electrical energy was placed at the same figure, assuming it to cost ½d. per unit. Mr. Smith mentioned again that the overall efficiency of the energy delivered at the axles of the locomotives was nearly 4 per cent. of the energy contained in the coal as burned in the fires. Did he know that the modern power station equipped with steam turbines and using all the latest appliances

to effect economy could give an efficiency of some 16 per cent. or even higher? He believed they had one case where 18½ per cent. efficiency was claimed. If they were only getting an efficiency of 4 per cent. on the railway system they were losing an enormous amount of energy between the switchboard in the power house and the train axle. He would like to know if there was no possibility of improving upon that figure. Mr. Smith dealt almost entirely with the limitations of electricity for railway purposes, but the speaker pointed out that these limitations were existing limitations. They should really look at this question a little more from the point of view of future requirements than in consideration of what was actually necessary to-day. Within the last few years the habits of the people in their large towns had completely changed in regard to transit. At the present time the inhabitants of London made six times as many journeys as they did 10 years ago. It was also a fact that since the Brighton Co.'s suburban line was electrified the traffic upon that section had increased enormously—so much so that he believed the directors had practically decided to extend the system to Brighton. That gave an idea of what they considered were the prospects of an electric railway. While the railway companies might have been handicapped, he agreed with Mr. Lackie that the companies had themselves to blame in some ways for being in such a position that they could not face the expense of electrification. The case for the electrification of railways must rest largely upon the density of traffic and the frequency of trains. If they could run 12 trains an hour over a given length of railway with the same capital charges on rails and overhead equipments, it stood to reason that the cost per train-mile would be cheaper than for running one train in every 70 minutes.

In the course of his reply, Mr. Smith held that where tramways ran alongside railways they did take away the traffic. In Glasgow it might be better to leave suburban traffic to the tramways as much as possible. In America electrification was forced on the railways by public demand, and it was only now beginning to be considered there in its economic aspect. As to railways reducing their fares to get more traffic, he contended that the chief difficulty was that railways were at the end of their tether for accommodation, particularly for terminal accommodation. The difficulties in range of speed became more and more marked as electrification was required for longer distances, and he thought designers should try to improve the single-phase locomotive. He could not give the chairman the details of how the 10½d. and 7½d. per train-mile were arrived at, as these had been given him on the understanding that he would not give full details. His calculations on the efficiency between the coach and the axle of the steam locomotive were based on a paper read by Mr. Hobart. He did not think it quite right to take anything more than 11 or 12 per cent. In the matter of speeds, he thought designers ought to be more alive to the disabilities of the series characteristic, and he suggested that they might with advantage study the shunt characteristic.

THE DESIGN OF ROLLING STOCK FOR ELECTRIC RAILWAYS.

By H. E. O'BRIEN, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *March 12th*, 1914).

Railways engaged in electrification of large suburban areas find that the cost of operation of the electrical services is an important proportion of their total expenditure; and bearing in mind the large addition to their original capital expenditure involved by electrification, every means of reducing both the capital cost and the cost of operation becomes a matter of serious importance, and worth the minutest investigation.

A time limit of 45 minutes for suburban journeys represents a a radius of 22 miles at a schedule speed of 30 miles per hour. With stops one mile apart, such a schedule is practically the highest attainable with any type of train or motor.

It will often happen that a profitable electrification will involve runs with very short distances between the stops in the vicinity of a large town, and with much longer distances between the stops as the train gets farther from the urban area; very possibly at the extremity of the electrification a secondary urban area is approached, necessitating a number of stops in close proximity to each other.

The most remunerative traffic will be that between the extremities of the electrification; consequently the equipments will have to be designed so as to make a journey, of this length a reasonable one. The gradients also vary, and expresses as well as stopping trains will be required; as in most cases the setting aside of special stock for express services would involve extra capital expenditure, a compromise has to be accepted both in the motor characteristic and in the gear ratio. In consequence the equipments will normally run in such a way as to require a high energy consumption. This energy consumption is the sum of that wasted in the resistances and motors, of that wasted in the brakes, and of that utilised in overcoming train resistance. The first two of these losses are directly proportional to the weight, and the third —the train resistance—is so nearly proportional to the train weight that it may be taken as being so for practical purposes.

Fig. 1 shows the resistance of the Lancashire and Yorkshire Railway Co.'s trains as actually obtained by the coasting method.

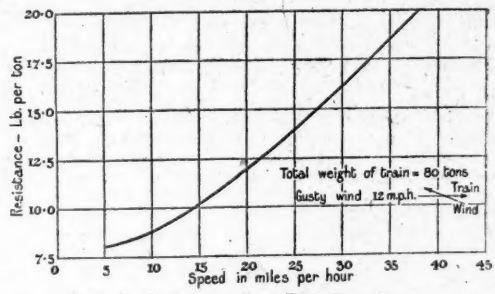


Fig. 1.—Resistance of Two-Car Train.

Fig. 2 shows the approximate division of the total energy between its various components.

The curve in fig. 3 shows the percentage of the whole used for acceleration for runs of half a mile and upwards. This curve emphasises the enormous importance of light rolling stock on high

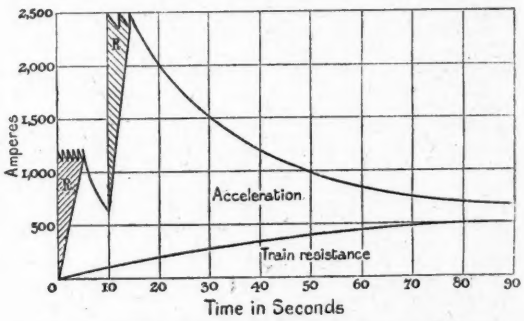


Fig. 2.—Typical Curves showing Energy Losses.

schedule short-distance suburban services. It is therefore very important to consider in detail how rolling stock may be built so as to give a maximum value to the ratio—number of seats provided per ton weight of train.

The necessary protection against the possible effects of collision and fire must be provided, but such protection is not necessarily obtained by extra weight. The disastrous effects of collisions are

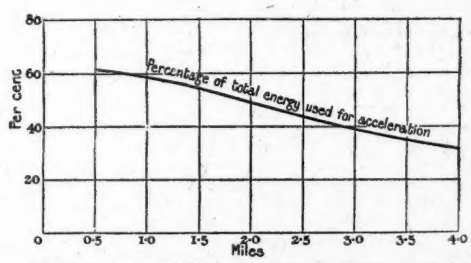


Fig. 3.—Curve showing Percentage of Energy input for Acceleration for Runs of Half-Mile and upwards.

mainly due to the frame of one coach over-riding the frame of another and the bogies being packed together under the coaches. It is not a difficult matter so to design the ends of the underframe as to prevent over-riding of one underframe upon another, and in the United States it is proposed that the bogies should be anchored more securely to the bodies in order to throw more of the energy lost by the collision into the bogies and to use them as stops to prevent over-riding. Non-inflammability has hitherto been secured by the extensive use of steel instead of wood, but there is no reason why a lighter metal should not be used.

Lightness of construction may be obtained either by using reduced scantlings, which is undesirable as involving a reduction in the factor of safety, or by using lighter materials, or by using materials of greater intrinsic strength, thus enabling the scantlings to be reduced without sacrificing the strength of the whole structure.

Assuming 100 watt-hours per ton-mile at the ends of the high-tension feeders as a typical energy consumption in the near future, and 60,000 miles per annum as a probable mileage per car per annum, then every ton of motor-car involves a consumption of 6,000 kw.-hours per annum. This is equivalent to an annual expenditure of £12·5 per annum per ton for energy if a total cost of 0·5d. per unit is assumed.

The cost of repairs to each ton of rolling stock will amount to about £5 per annum for a high-speed service; and its passage over the rails will probably involve repairs to the track equivalent to

another £1 per annum, or a total cost per ton of motor-car of £18·5 per annum. On similar lines the cost per ton of trailer-car will be about £14·5 per annum, the energy charge remaining constant and the other charges being smaller. The capital cost per ton of motor-car will be approximately £70, and per ton of trailer £45. Hence every ton of weight saved represents (taking interest and depreciation on capital at 10 per cent.) a total saving per annum of £25·5 per ton of motor-car and £19 per trailer-car per ton per annum. It becomes, therefore, a commercial proposition to spend as much as £185 per motor and £145 per trailer in labour and material in order to save a ton in weight on the particular service chosen for this illustration. The smaller the system and the severer the schedule, the more important is the weight of the train.

Extra seats can be given by extra width, with a smaller increase in weight than by extra length. It does not appear necessary or desirable to make suburban stock of such dimensions that it will conform to the minimum loading gauge for the whole of the system. If 60-ft. coaches are used, an extra 12 in. in width will give 15 more seats on a basis of 4 sq. ft. per passenger; five seats can be given crosswise instead of four. If the average coach seats 100, 10 more seats per car will result in a 10 per cent. decreased capital expenditure on rolling stock. The additional seats gained by the extra width represents 1 cwt. per seat. If this extra seating is provided by extra coaches, an extra weight of about 5 cwt. per seat is involved.

The comfort of the corridor coach is greater than that of the side-door coach, and the possibility of moving along a train in search of a seat or of friends is much appreciated. The absence of doors decreases the cost of maintenance, and appreciably increases the strength of the body, while ventilation and heating can be carried out more uniformly and efficiently. The ventilation of the cars has considerable influence on the energy consumption of the coaches, because the heating load becomes very appreciable in cold weather. On interurban railways in the English climate it may be estimated that there will be at least an increase of 9 per cent. in the load in the winter months due to heating only. It is most important to secure a minimum weight for the heating equipment, and it would pay so to arrange it that it could be entirely removed when not required.

Ventilation can be effected on the elliptical type of roof by means of fans or by a set of torpedo extractors. The result of adopting the corridor coach with an efficient system of ventilation and heating is a uniformly warm and comfortable coach—a result which cannot possibly be obtained with side doors. The absence of doors which may fly open and foul trains on an adjacent track enables the maximum width of coach to be used, with a consequent increase of earning capacity, and also does away with the possible danger of trains leaving a platform with the doors adjacent to the seats in an open position.

A light body with weights distributed to the best advantage permits the use of a lighter underframe, and this in its turn reduces the rated horse-power of the motors for a given schedule. The reduction in the rated horse-power of the motors permits of lighter bogie scantlings, and also in many cases of a lighter design of control apparatus. The influence of the weight of the body is therefore progressive throughout the whole car, and for every ton of weight saved in the body it is probable that another ton can be saved in the bogies and motors.

The elliptical roof is lighter than the clerestory type, and also enables a coach to be more uniformly lighted, owing to the superior reflecting qualities of the smooth surface of the elliptical roof. The clerestory roof is inherently weak, and is specially unsuitable where bows have to be supported on the roof.

Very little difference is made in the weight by the use of any material other that wood for the roof sticks and pillars. There is little object in using steel for the pillars, as some of the Australian hard woods are practically as non-inflammable as metal.

There is practically no difference between the weight of the roofing in a wood or aluminium roof, but approximately half a ton in weight can be saved on a 60-ft. car by the use of an aluminium roof instead of a steel roof. Aluminium, in addition to its extremely light weight, has the advantage of being non-corrodible, and therefore requires very much less painting than either steel or wood. By the use of aluminium for the outside panels a saving of nearly half a ton can again be effected as compared with steel.

The weight of the glass in a modern coach is a very considerable item, amounting to 7 cwt., or 1·4 per cent. of the weight of the whole coach.

It is also possible to effect economies in the seats. Fixed seats should always be used. Fig. 4 shows how fixed seats provide increased seating accommodation.

It would seem probable that the floor of the future would consist of corrugated aluminium plates filled in with some form of composition, such as treated cork, to a sufficient depth to cover the crests of the corrugations by about ¼ in.

Up to now the use of a high-tensile steel has not been sufficiently considered in the construction of underframes; such steels have been extensively used in motor-car construction and in bridge building.

Nickel and vanadium steels are nearly twice as strong as the steel usually employed to-day, and in consequence the scantlings can be reduced. The weight of an underframe for a 60-ft. trailer coach is approximately 5 tons. Nearly a ton of this weight might be saved by the use of suitable material.

As the first cost of underframe material is low and will never exceed more than £7 10s. per ton, any saving in weight made by the use of more expensive material will easily pay for itself.

The disposition of the weights of the apparatus attached to the underframe has a considerable effect on its design; the weight per foot-run, and the brake, resistances, and control apparatus of the motor-cars should be distributed as far as possible along the length of the body, even if it involves some slight increase in the cost of cabling.

There is a considerable field for a high-speed vacuum pump of light weight. The reservoirs which are essential to the vacuum brake should be made of aluminium. In connection with the contactors, wherever possible aluminium should be used rather than copper.

The equalising type of bogie is quite unsuitable for English railways with their excellent permanent way. The ordinary type of bogie used for carriages on the steam railways of this country may be built with elliptical or spiral bolster springs, either outside or inside the wheels. There is a considerable advantage in putting the springs inside the frames, as this enables the bolster to be made wider and the bolster spring to be put farther away from the centre-pin of the bogie, thus tending to diminish rolling.

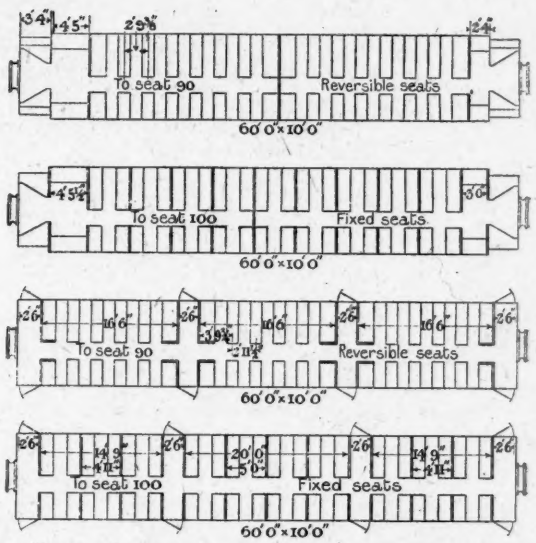


Fig. 4.—Seating Accommodation with Fixed and Reversible Seats.

There is a considerable saving by using spiral bolster springs instead of elliptical bolster springs; nearly 0·75 ton per coach can be saved in this way. The best results are obtained by having short, stiff semi-elliptical springs over the axle-boxes with assistant helical springs at their ends, and helical springs on the bolster. The wide frame involves an increase in weight; but on account of the steadier riding obtained by the wider centres of the bolster springs it is worth having.

Cast-iron is very usually used for axle-boxes, but cast-steel axle-boxes and cast-steel axle-box slides will enable the weight of these parts to be reduced by 22 per cent.

The totally enclosed railway motor has not been found really necessary in this country. The motors operated by the Lancashire and Yorkshire Railway Co. are run continuously with as many ventilating openings as possible, and no trouble has been experienced, except on one occasion when very fine snow was being blown horizontally in large quantities, and even in this case the trouble arose more with the resistances than with the motors. In order to get a light motor it should be of the self-ventilating type, and the movement of the armature should produce a powerful draught through the motor.

Better results can be obtained with independent blower sets, but the complication of having an additional small motor to maintain, and the necessary air ducts, does not compensate for the saving effected. Generally speaking, a light motor means a high-speed motor, and a large gear ratio; but it will be found cheaper to renew gears than to carry a standing charge for moving an unnecessary weight.

Discussion.

Mr. W. Casson, in opening the discussion, said he thought the author had gone a little too far in estimating the probable saving due to small savings in weight. On the Central London Railway the stock was lighter, but the costs of maintenance were much more than with the heavier stock of the London Electric Railways. This was also the case as between the old and new types of District Railway stock; he found on comparison that more room was given to the passenger in the District coaches than in the new Lancashire and Yorkshire coaches described in the paper. He agreed that the automatic vacuum brake was a simpler apparatus than the air brake, but could not call to mind any railway like the District using it. In regard to the design of truck shown, some of the trucks used on the District trains dispensed with elliptical springs, using helical springs throughout. In the building of motor-trucks a lesson could be learnt from steam locomotive practice; the motor

bogie had, proportionately, much more work to do than the locomotive bogie. As the result of experience on the District Railway, cast-steel axle boxes had been superseded by cast-iron boxes.

Mr. H. W. Firth said he noticed that the author emphasised the importance of variable motor characteristics, even for suburban work. Judging by the remarks on weight disposition, it seemed that single-phase equipment would be worse than direct-current, owing to its greater work on the underframe. The new type of coach referred to by the author, with its extra width would only accommodate 1·6 seats per ft. of train, as against 1·8 in the case of side-door trains, and he thought the latter could be emptied in less time. He asked what was the limit of weight with a side-door car as compared with the author's corridor type of car, and whether rail wear had any influence in the choice of a 10-ft. wheel base bogie. The very wide coaches would not be practicable on many of the London suburban lines.

Mr. J. B. Sparks criticised the author's conclusions regarding expenditure with a view to saving weight, pointing out that experience in electric tramway and railway working had resulted in the use of heavier rolling stock and decreased maintenance. He also submitted that it was quite wrong to estimate the cost of energy, repairs, &c., on a pro-rata basis with the weight of the coach.

Mr. R. H. Burnett urged that railway experience showed the necessity of making motor bogies strong, and certainly not saving weight there. He was also satisfied that long-wheel base was the correct thing, resulting in a reduction of flange wear and easier riding on curves. Large diameter wheels were also preferable, if the conditions allowed of their use.

Mr. C. L. Mason said the trend of modern coach design was all towards heavier vehicles, and this was due to the greater comfort demanded, the more strenuous conditions of use and the steadier riding qualities of the heavier vehicle. Maintenance charges were the real index to the value of the proposed saving in weight, because such costs made a greater impression in the balance-sheet than occasional extra capital expenditure.

Mr. Bowden said several speakers appeared to be against the saving in weight, but he thought they omitted consideration of rational design and that weight reduction in materials need not imply reduction in strength.

It was necessary to consider truck design from the locomotive point of view—the two motors would probably develop as much as 750 h.p. Retardation was as important as acceleration in suburban service, and he questioned whether the vacuum brake would secure this so well as the quick-acting air brake. He suggested that if a split gear wheel were used instead of the type shown on the author's truck, it would save pulling off the adjacent wheel each time the gear was changed.

As regarded the question of side door and corridor construction, experience on the Metropolitan Railway showed that the compartment coach was better appreciated by both the public and the traffic staff.

Dr. S. P. Smith, speaking on the question of motor characteristics, referred to the necessity of obtaining more elasticity of speed control—some improvement on the series-parallel arrangement. A form of field control placing the poles in parallel or diverting some of the field current appeared to be a possible method of obtaining wider characteristics. Greater advantage could also be taken of interpole construction.

Mr. F. W. Carter pointed out that train resistance when running was not so great as when coasting, when the friction of the motors was added. At 20 m.p.h. coasting speed motor friction had been found to amount to about 4 lb. per ton, and the resistance curve given in the paper evidently included this, and appeared above the normal. He agreed that a saving in weight was worth obtaining in suburban stock where there was frequent starting and stopping, though this did not apply to main line working. The only saving resulting from weight reduction would probably be in energy cost. He agreed with the author that the ventilated motor was quite suitable for use in English work.

The Author, in replying, said that with 56 trains on the line the load was largely evened up, though not necessarily level. Experience in the North showed that repairs were largely proportionate to tonnage, and the light cars had shown themselves to be cheap in repairs. He thought that repair costs were very nearly proportional to the weight of the cars. He did not see why the vacuum brake should not give as good retardation as the air brake; the question of rapid production of the vacuum was a difficulty, but it was possible to get the vacuum on a five-car train in 15 seconds. High-speed collisions would inevitably cause telescoping, but it was possible to diminish this by strengthening the ends of the coaches and fastening the bogies to the underframes, thus providing additional weight to be lifted.

The side-door coach gave about 20 per cent. extra seating capacity over the corridor coach, but it was not so suited to the requirements in Lancashire. It required more platform staff, and, in any case, the corridor train would empty itself in the time it took for the driver to change ends. Rail and tire wear had not been decreased by the introduction of the long-wheel base bogie as expected. The motor-car was more expensive to build than the trailer car, because provision had to be made to accommodate the electrical contactors, rheostats, &c., involving changes in the framing; otherwise the cost was much the same as for the trailer car. Dr. Smith's suggestion to strengthen the field with the aid of the interpoles would need consideration. In lightening the construction it was not his intention to diminish the strength of the car, but to dispense with *unnecessary* weight only. This could be done. Putting steel panels and roofs on coaches was throwing money away. The gross weight of the car body reacted on every detail of the construction.

GAS POWER PRODUCTION AT COLLIERIES.

The *Gas World*, of March 7th, reproduces in abstract two papers that were read at a recent meeting of the Midland Institution of Mining Engineers—"The Development of the Gas Engine in England, and its Adaptation to the Generation of Power at Collieries and Iron Works," by Mr. T. C. Wild, and "Modern Gas Engine Practice for Collieries," by Mr. A. T. Cocking. In both cases reference was made to the waste entailed by the manufacture of coke in beehive ovens.

Mr. Wild said that blast-furnace gas was undoubtedly one of the best for use with large gas engines, producer gas coming next, and then coke-oven gas. The main difficulty with coke-oven gas had been in many cases its high sulphur content, which caused corrosion in the cylinders. This defect should be removed by passing the gas through purifiers. The second objection was its high percentage of hydrogen; this, whilst giving a high calorific value, also gave a strong tendency to pre-ignite when under compression.

Mr. Cocking dealt especially with the use of low-grade fuel for power raising purposes, and with the choice of engine units.

He said that the possibility of generating gas from waste fuel must now be recognised as a means of supplying most, if not all, the power required for the work of a colliery, and this source of power, added to that recoverable by utilising the gases generated in coking coal, pointed to the probability that, in the near future, a modern colliery would be in a position not only to generate its own power without using its saleable fuel, but also from the same source to supply electrical current to neighbouring factories for power, or to townships for light; taking into consideration the unique advantages which a colliery possessed in having its saleable fuel at first cost, it was not an extravagant prediction to say that, in the future, by means of judicious blending of the cheaper kinds of its saleable fuel with its available waste, and by the full use of the products of its coking plant, an up-to-date colliery would become a great power-generating centre, the revenue from which would be the predominating factor in its profits. He strongly preferred the horizontal to the vertical type of gas engine.

For use in colliery gas engines, regularity in the composition of the gas was more important than a high thermal value, and it would be necessary either to allocate a separate power system to coke-oven gas and producer gas, or to blend them in fixed proportions by means of gas holders. A battery of 100 modern regenerative coke ovens would carbonise, approximately, 150,000 tons of coal per annum, with a gross yield of 10,000 cb. ft. of gas per ton, which would allow about 5,000 cb. ft. per ton available for the generation of power. If the mean lower calorific value were taken as 400 b.th.u. per cb. ft., this would develop approximately 5,000 h.p. continuously during a year of 300 working days. This would require augmenting by 15,000 continuous h.p. generated by a mixture of slack with as much batt and other colliery waste as might be available, all of which would be gasified in a power producer. The average thermal value of this mixed gas would be about 225 b.th.u. Gas generated from colliery waste would contain more sulphur than that obtained from good coal, owing to the decomposition of the pyrites always present in the waste; therefore gas obtained from this source, and also from coke ovens, should be purified from sulphur (the recovery of which would always pay for the operation). The effect of the sulphuric acid resulting from the combustion of the sulphur products in the cylinder of a gas engine was very injurious, by its corrosive action on the metallic surfaces.

It was fair to assume that the value of the coke and ammonium sulphate would pay for the cost of coking the coal and allow a sufficient margin of profit on that operation without placing a specific value on the recovered gases. With such a combination the total cost of producing power, harnessing it, and converting it into electrical current, including wages, stores, repairs and all dead charges, with an allowance for the added fuel, should result in the generation of electric power at the exceedingly low rate of approximately 0·18d. per Board of Trade unit.

Concert.—The staffs of Messrs. Siemens's departments at Upper Thames Street and Dalston combined to spend a most enjoyable evening last Friday at their Bohemian Concert. The dining hall at Anderton's Hotel, Fleet Street, was filled with about 300 people, all in the best of Siemens spirits. Mr. A. H. Bate took the chair for the first half of the programme, and Mr. W. Le Marechal for the second. Both gentlemen delivered short speeches, expressing great pleasure at the very amicable relations existing between the two departments. Judging from the response to the toast of the respective departments, the two sections appear to work in that complete unison so greatly to be desired in all large firms. Mr. E. C. Laughton, in replying to the toast to the Dalston staff, also emphasised the good relationship between the two departments, which, he pointed out, must necessarily tend to efficient working. An excellent programme was provided. Two of the artistes are on the staff, Miss Ruby Newton delighting the company with many charming songs, and Mr. J. A. Sloane also receiving a great ovation. Among other artistes were Miss Christine Hicks, L.R.A.M. (violin solos), Miss Nellie Perryer (humorous songs), Messrs. Leonard Harris, Ben Osborne and George Blackmore (humorous sketches and songs).

BRITISH ENGINEERS AND CHINESE TRADE.

A report has been furnished to us of the proceedings at the second annual dinner of the British Engineers' Association, held at the Hotel Metropole, on March 6th. Mr. Douglas Vickers, the president of the Association, was in the chair, and in proposing "Anglo-Chinese Relations," he welcomed H.E. Dr. Chin-Tao Chen, the Commissioner for Finance, and expressed the good wishes of every Englishman towards the endeavours of the Chinese Government to establish popular rule. He proceeded to deal more particularly with the relations between the two peoples, and the relations of trade and commerce which touched them as members of the Association. The times had changed, and their competitors no longer went forth as individualists, but as compact bands, backed by their respective governments, making a combined attempt to wrest from them the trade which they had come to look upon as their own. They had not been able to follow these methods quite so much as they should have done, but this Association was a step in the right direction. They wanted to put the case of the British engineering manufacturer before the Eastern Powers as a whole. They wished to organise like their competitors, though, as an association, they were not intending to get orders direct, but to work by influence. They had to some extent been successful. "During the year we have caused the equipment to be supplied to the mechanical laboratory of the University of Hong Kong." The rising generation in China should be educated by British ideas, by British methods, and perhaps by the English tongue, and then it would come to England for supplies. It was quite natural that the British Government should not think it right to help an individual manufacturer, but they could certainly help an association without giving cause for complaint.

H.E. Dr. Chin-Tao Chen, responding, said that it appeared that the association had a very worthy and noble object—to protect British manufacturers and Chinese consumers. It sought to further British trade by fair dealing, by enlightening and educating the Chinese people to appreciate the quality and value of British goods, and to cultivate friendly relations and goodwill between the two nations. "The British nation possesses the lion's share of China's foreign trade, and, from recent investigations by an expert, it appears that you have also the greatest amount of capital invested in my country. In round figures, you have about £40,000,000 invested in the Republic of China to-day—almost three times as much as the French, who are reputed to have the greatest amount of surplus capital for foreign investment. If China is prosperous, British trade is bound to flourish; British manufacturers will be busy, and Chinese bonds happy. Thus the interests of Great Britain and China are common. China now regrets that she is not in a more favourable position to render you as much help as she desires. She is bound hand and foot—in her early years of ignorance and indiscretion—by treaties. Now she has learnt that machinery and commodities such as are manufactured by the members of this association are productive agents whose importation should be encouraged. She has also learnt that revenue must be regularly found to maintain the organisation of the Government, but by treaties China is not allowed to increase the taxation on luxuries in order to give greater freedom and encouragement to productive agents." In regard to "fair dealing," many of the co-called "unfair dealings" and subsequent disputes in foreign trade in China were caused by misunderstanding and ignorance of the laws and customs of the nations. Such was more often the case than real intention to deal unfairly. The various Consular Courts and the Mixed Courts might settle some of the difficulties, but they could not solve the whole question. "In these courts cases are tried under the law of the nation to which the defendant belongs, and there exists therefore an element of uncertainty in every contract made between a Chinese and a foreigner. For instance, if a Briton and a Chinese make a contract, neither knows which one might be the defendant in court, and consequently no one knows at the time a contract is made what the construction of it may be. This uncertainty, you can readily see, cannot but hinder trade and produce bad feeling and trouble. The only final solution is for China to frame her laws as nearly as possible like those of the nations of Europe, and to compel all nationals residing in the country to abide by these laws." The speaker next referred to some of the reasons for the decline of British trade and prestige in China mentioned in the report of the association. "You complain of the lack of support given to British loans for industrial purposes in China, and also of the dishonourable means by which competitors of Great Britain seek to obtain business and concessions to the exclusion of the British manufacturers. Such things are always regrettable, but I believe the accounts of them are more exaggerated than otherwise. . . . . China is perfectly solvent under normal conditions, but has incurred heavy and unusual liabilities during the revolution. At such a time she ought to be accorded all possible aid by friendly nations until such a time as it is possible for her to put her house in order. To restrict her in her hour of necessity from freely borrowing may be good in theory, but the pressure of want will compel her to turn to those who are willing to advance her funds. The result, I am sorry to say, operates against the good intentions of British interest."

Mr. R. S. Lloyd proposed "Our Guests," and Sir Walter Langley responded.

Mr. Wilfred Stokes, chairman of the association, proposing "The British Engineers' Association," mentioned that whereas a year ago their membership was only 93, it was now 204. Last year it represented a capital of about £39,000,000, and to-day £80,000,000. They had sent out to China their Chief Commissioner, his assistant, and their engineer; and upwards of £10,000 worth of machinery had been supplied by their members to the University of Hong Kong. They had appointed a strong committee to deal with the important question of finance, in the hope of making such arrangements in the near future with regard to finance as would allow their members to shoulder contracts that otherwise it would have been impossible to contemplate.

The President and Mr. Stafford Ransome, the secretary, responded.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIA.—Applications have been received by the Inter-State Commission, which is investigating the working of the tariff, for further tariff assistance in the following cases, the duties quoted are those now levied under the preferential tariff for British goods where preferential treatment exists:

Electric radiators; gas and electric fittings ...	25 p.c. ad. val.
Electric radiator fittings	10 p.c. ad. val.

An application has also been received in opposition to the extension of the preference to British goods in the case of telephones, telephone switchboards and appliances. Consideration of these applications and evidence in their support will take place in due course.

HOLLAND.—The Dutch Customs authorities have issued the following decisions concerning the tariff treatment of certain electrical goods:

Apparatus for receiving submarine bell signals (consisting principally of two cast-iron tanks fixed to the ship's side, each tank containing a microphone connected by an electric cable with a telephone on board the ship) if the component parts are imported together ...	Free.
Stretching slide rails generally used for moving dynamos or motors erected on them in order to tighten slack driving belts	Free.

FRANCE AND ALGERIA.—A circular issued by the French Customs authorities prohibits the importation into France and Algeria of goods marked with a red cross on a white ground and the words "Red Cross" or "Geneva Cross," or of which the papers, wrappings or packings are so marked, and directs the Customs officers to cause such goods to be re-exported to the place from which they were sent.

GRENADA.—Regulations and forms of certificates of origin to be complied with in order to secure admission for British goods into Grenada, which is made possible in view of the accession of Grenada to the terms of the Canada-West Indies Treaty.—These regulations and certificates are in the main similar to those for the other West Indian Islands, already in force, but they are printed in detail in the Board of Trade Journal of March 12th.

ITALY.—The Italian Customs Authorities have decided that insulating cords of a thickness greater than 2 m/m. composed of a plaited tubular covering of jute yarn filled with a certain flour (farina fossile) shall be dutiable at the rate of 14 lire per 100 kilogs.

RUSSIA.—In a recent dispatch to the Board of Trade the British Consul at Warsaw points out that samples which are liable to Customs duty on entry into Russia should be sent by parcel post, and not by sample post, since in the latter case they are returned to the sender.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

5,263. "Means of securing electric lamps to the holders." J. W. Gregg and A. Gregg. March 2nd.

5,281. "Wireless oscillator." H. P. Dwyer. March 2nd. (Complete).

5,294. "Telegraphy." W. Judd, A. Fraser, K. L. Wood and Eastern Telegraph Co., Ltd. March 2nd.

5,315. "Automatic device for the lubrication under pressure of trolley wheels and the like." J. Drapier & F. Gillet. March 2nd.

5,345. "Reflector for arc lamps." H. E. Moul (Korting and Mathiesen Akt-Ges., Germany). March 2nd. (Complete).

5,346. "Electric horns or signal alarms." W. W. Dean. March 2nd. (Convention date, March 15th, 1913, United States). (Complete).

5,347. "Electric horns or alarms." W. W. Dean. March 2nd. (Convention date, October 15th, 1913, United States). (Complete).

5,351. "Electrical train controlling systems for railroads." H. J. Warthen. March 2nd. (Complete).

5,354. "Electrically controlled locks." L. Cadenel. March 2nd. (Complete).

5,359. "Electrical fuse boxes." P. Rosling, W. H. Nichols and W. T. Henley's Telegraph Works Co., Ltd. March 2nd.

5,360. "Electrical switches." B. D. Horton. March 2nd. (Complete).

5,365. "Electricity meters." J. Elster. March 2nd. (Divided Application on 5,157/13. February 28th). (Complete).

5,370. "Apparatus for radiating or receiving electromagnetic waves on aeroplanes, airships and the like." H. Fothergill. March 3rd.

5,380. "Electric re-lighting apparatus for safety lamps, as used in mines." J. J. Pugh. March 3rd.

5,394. "Electric generators." A. Kenyon and W. Torrance. March 3rd.

5,414. "Electrode holders for electric furnaces." Fried. Krupp Akt.-Ges. March 3rd. (Convention date, December 13th, 1913, Germany). (Complete).

5,431. "Electrical switches." B. D. Horton. March 3rd. (Complete).

5,439. "Artificial candle fittings for electric light and other means of illumination." F. R. Wade. March 3rd.

5,454. "Marine mines." E. Senger and R. Sauter. March 3rd.

5,455. "Protective devices for alternating-current electric generators." British Thomson-Houston Co., Ltd. & E. B. Wedmore. March 3rd.

5,456. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States). March 3rd.

5,459. "Manufacture of plastic masses particularly suitable for insulating purposes." A. Regal. March 3rd. (Convention date, March 7th, 1913, Austria). (Complete).

5,467. "Switchgear for a plurality of conductors, machines, or apparatus to be connected with the same busbar." Allgemeine Elektricitats-Ges. March 3rd. (Convention date, March 4th, 1913, Germany). (Complete).

5,491. "Electric lanterns and the like." M. A. Codd. March 4th.

5,501. "Means for operating upon earthenware chiefly in the production of electric insulators and the like." H. L. Doulton and H. Morris. March 4th. (Divided Application on 6,421/13. March 15th).

5,505. "Electric regulating switches." L. Miller and L. Boothman. March 4th. (Divided Application on 6,371/13. September 13th). (Complete).

5,506. "Casing for portable electric battery lamps." B. Pordes. March 4th. (Complete).

5,509. "Alternating current motors." L. J. Hunt and Sandycroft, Ltd. March 4th.

5,510. "Machine telephone switching systems." Western Electric Co., Ltd. (Franklin Tuthill Woodward, Belgium). March 4th. (Divided Application on 5,653/13. March 6th).

5,511. "Electric compound transformers." Briger Holm-Hansen. March 4th. (Convention date, March 5th, 1913, Norway). (Complete).

5,513. "Electro-magnets and their application to brakes, clutches and the like." J. P. Hall & Co., Ltd., and A. Nield. March 4th. (Complete).

5,514. "Starters for electric motors." Siemens Bros. Dynamo Works, Ltd. and E. Schupp. March 4th. (Complete).

5,515. "Automatic current interrupter for high-tension overhead lines." W. Lehmann and H. Thomas. March 4th. (Complete).

5,521. "Electrical control systems and switch mechanism therefor." R. Amberton. March 4th.

5,523. "Dynamo electric machines and the like." J. E. Westlake. March 4th.

5,535. "Wireless telegraphy." G. Leimbach. March 4th. (Convention date, March 4th, 1913, Germany). (Complete).

5,542. "Protective devices for electric distribution systems." E. E. Creighton. March 4th. (Convention date, March 19th, 1913, United States). (Complete).

5,544. "Method of interconnecting lines by electromechanically-controlled switches." F. Aldendorff. March 4th.

5,556. "Generation of electric power." E. W. S. Bailey and H. Parker. March 5th.

5,561. "Electrical wiring-systems and junction-pieces therefor." Anderson and Munro, Ltd. and A. W. Brown. March 5th.

5,583. "Method of making electrostatic condensers." G. B. Burnside and Glasgow Scientific Instrument Co. March 5th. (Complete).

5,587. "Means for use in supporting separator diaphragms used in storage batteries." Electrical Power Storage Co., Ltd., and R. Rankin. March 5th. (Complete).

5,604. "Electro-magnets." W. J. Branson. March 5th.

5,605. "Apparatus for controlling the rotation of engines, motors, or machines, so that rotation shall be prevented except when in accordance with the direction indicated by an order, telegraph or the like." E. S. Vincent. March 5th.

5,611. "Fluorescence tube." M. Schmierer. March 5th. (Convention date, March 5th, 1913, Germany). (Complete).

5,616. "Make-and-break switches." R. Hacking and C. F. Hamley. March 5th.

5,630. "Manufacture of electric lamp filaments, electric resistances and the like." F. Harrison. March 5th.

5,639. "Electric current relays." British Thomson-Houston Co., Ltd. (General Electric Co., United States). March 5th.

5,640. "Telephone instruments." Compagnie Francaise pour l'Exploitation des Procedes Thomson-Houston. March 5th. (Convention date, April 4th, 1913, France). (Complete).

5,662. "Suspension of electric and other lamps and other articles." G. A. Hughes (trading as London Electric Firm). March 5th.

5,663. "Electric lighting systems." G. S. Strahan and F. J. Harris. March 5th.

5,673. "Sparking-plugs." F. A. L. Johnson. March 6th.

5,691. "Voltage regulator or alternating-current generator of the low-tension magnetic type." G. E. Carr. March 6th.

5,693. "Electric arc lamps and electrical apparatus utilising a variable resistance." A. T. Dowdell. March 6th.

5,701. "Moving-coil galvanometers and the like." J. H. Care and L. W. Smith. March 6th.

5,718. "Spark gaps for radio-telegraphy and radio-telephony." W. T. Ditcham. March 6th.

5,725. "Electric lamp-holders." W. C. Hands. March 6th.

5,731. "Gas, water, electrical energy, or the like meters." J. Heussler. March 6th. (Complete).

5,767. "Means for regulating the voltage of direct current delivered by a rotary converter in conjunction with a high speed alternating current generator." E. E. Glover. March 6th.

5,776. "Contact-making volt-meters." British Thomson-Houston Co., Ltd. (General Electric Company, United States). March 6th.

5,779. "Transformer for transforming alternating current into continuous current." J. Herman and A. Riss. March 7th. (Convention date, March 7th, 1913, Germany). (Complete).

5,788. "Electric billiard-marking indicators." R. T. Malony. March 7th.

5,828. "Rotors for dynamo-electric machinery, and cooling arrangements for the same." Siemens-Schuckertwerke G.m.b.H. March 7th. (Convention date, March 10th, 1913, Germany). (Complete).

5,829. "Electrolytic detectors for use in wireless telegraphy or telephony." E. Howl and F. Perry. March 7th.

5,831. "Telegraphy." W. Judd, B. Davies and Eastern Telegraph Co., Ltd. March 7th. (Divided Application on 9,768/13. April 25th).

5,841. "Circuit arrangements for semi-automatic telephone systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt-Ges., Germany). March 7th. (Complete).

5,844. "Enhancing the permeability of magnetic material." E. Wilson. March 7th.

5,861. "Device for producing warning sound from electric energy taken from magneto as fitted to motor vehicles or internal combustion engines." A. Christmas. March 7th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

26,430. Electric Hauling Plant. Akt. Ges. Brown, Boveri, et Cie. November 18th. (November 17th, 1911.)

1913.

1,066. Electrical Accumulators. De Sedneff. (Patent of Addition not granted). January 14th.

1,413. Automatic Electric Supply Systems. H. Leitner. January 17th.

3,111. Fuses for Use in Electric Circuits. Spagnoletti, Ltd. and V. E. Joyce. February 6th. (July 25th, 1913).

4,164. Order Telegraphs. A. H. Pollen and H. Isherwood. February 18th.

4,618. Selective Signalling Systems. Western Electric Co. (Western Electric Co.). February 24th.

4,671. Electric Tachometers. N. M. Hopkins. February 24th.

4,723. Electrodes for Electric Furnaces for the Fixation of Nitrogen. E. K. Scott. February 24th.

4,724. Electrodes for Electric Furnaces. E. K. Scott. February 24th.

4,725. Means for Regulating Arc Furnaces. E. K. Scott. February 24th.

4,777. Apparatus Employed for Wireless Telegraphy and the like. F. J. Chambers. February 25th.

4,829. Electrical Order--Transmitting Systems and the like. E. A. Graham and W. J. Rickets. February 25th.

5,014. Dynamo-Electric Machines, and more particularly Commutating Arrangements therefor. C. A. Vandervell and A. H. Midgley. February 27th.

5,250. Submarine Signalling Apparatus. E. C. R. Marks (Submarine Wireless Co.). March 1st.

6,341. Safety Signalling Arrangements, particularly applicable for use on Board Ship. R. W. Williams. March 14th.

6,462. Secondary Electric Batteries. B. Heap & Chloride Electrical Storage Co. March 15th.

6,880. Fuses for Electric Circuits. Siemens Schuckertwerke Ges. March 20th. (March 21st, 1912).

7,085. Electric Switches. A. P. Lundberg, G. C. Lundberg, P. A. Lundberg and G. Pegg. March 25th.

7,585. Signal Systems for Railways and Apparatus for use therewith. E. C. R. Marks (Gilman). March 31st.

8,417. Manufacture of Material Suitable for Electrical Insulation and other purposes. British Thomson-Houston Co. (General Electric Co.). April 19th.

8,561. Electric Contact-makers. G. W. Black. April 11th.

8,568. Incandescent Electric Lamp. C. Giusti. April 11th.

8,615. Prepayment Automatic Telephones. L. Breguet and Freres Breguet et Cie. April 12th.

8,741. Electric Contact and Fire-alarm Device. A. V. Clorius and O. T. Clorius. April 14th.

9,009. Apparatus for Electric Lighting, Heating, and Ventilating of Railway Carriages or other Moving Vehicles. T. Ferguson and J. R. Johnstone. April 17th.

10,098. Lighting Operating or like Tables. H. Wade (Schneider and Naujoks Elektrizitäts Ges.). April 29th.

11,278. Electrolytic Process and Apparatus for Manufacture of Sodium and other Alkali Metals. E. Marguet. May 14th. (April 9th, 1913).

13,844. Electric Measuring Instruments of the Moving Coil Type. W. Phillips and L. W. Smith. June 16th.

14,816. Electric Switches. M. S. Conner and A. R. Kahl. June 27th.

14,927. Arrangements for Producing Electro-magnetic Oscillations Particularly for Use in Radio Telephony. W. T. Ditcham and Grindell-Matthews Wireless Telephone Syndicate, Ltd. June 28th.

15,576. Locking Electric Lamps. H. Hubbell. July 5th. (April 9th, 1913).

17,126. Measuring Instruments for High Frequency Currents. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). July 25th.

17,514. Sparking Plugs. E. C. R. Marks (Siemens & Halske Akt. Ges.). July 30th.

17,816. Mine Signalling Apparatus. R. Nicholas. August 5th.

18,252. Electric Starting-device for Internal Combustion Engines. L. Renault. August 11th. (August 12th, 1912).

19,512. Electric Transformers and Welding, Smelting and like Apparatus. R. Mack. August 28th.

19,648. Polyphase Current Motor Starters. Voigt & Haeffner Akt. Ges. August 30th. (December 23rd, 1912).

21,766. Circuit Arrangement for Semi-automatic Telephone Systems. Siemens & Halske Akt. Ges. September 26th. (September 26th, 1912. Addition to 6,664/13).

23,739. Contact-breaker for Magneto-electric Ignition Apparatus. Unionwerke Mea Ges. Elektrotechnische Fabrik Eisenwerk. October 20th. (December 5th, 1912).

25,141. Electrical Connectors for Electro-medical Apparatus. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). November 4th.

25,163. Automatic Regulating Devices for Electric Distribution Systems. British Thomson-Houston Co. & C. McCarthy-Jones. November 4th. (Divided Application on 25,286/12. May 5th, 1913).

25,207. Submarine Signal-receiving Apparatus. C. Berger. November 4th. (November 4th, 1912).

26,913. Arc Lamps. A. W. Penrose & Co. & M. Owen. November 22nd.

27,754. Telephone Exchange Switchboards. E. A. Graham. December 2nd.

27,878. Arc Lamps. Korting & Mathiesen Akt. Ges. December 4th. (December 21st, 1912).